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EDITED BY
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International Review devoted to the History
of Science and Civilization.

SUMMARY

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(Edited in Cambridge, Massachusetts, May 1921.)

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Different types of mathematical history

Among the various general histories of mathematics the two written by J. E. MONTUCLA and M. CANTOR were especially favorably received. The former of these is frequently spoken of as the earliest real history of our subject and served to a large extent as a prototype for the latter and for many other less influential undertakings along this line. It is therefore of interest to consider some of the characteristic features of these two works. One of the most striking features is that their authors express their own opinions in no uncertain terms on a large number of fundamental questions. These authors did not seem to endeavor to efface themselves but they present fearlessly conclusions which they had reached after investigating thoroughly the various evidences available in their days, and they often supplement facts in somewhat the same manner as lost Greek works used to be restored from the notes of PAPPUS and others.

The many appreciative comments which these histories have evoked tend to show that a considerable body of readers of general histories of mathematics desires not only the evidences but also the conclusions gained by men who were in position to consider these evidences carefully and comparatively. The many lofty and inspiring remarks which those thoroly familiar with the history of our subject are in position to make constitute features which are more attractive to most readers than collections of facts without any attempt to interpret them. Such collections are, however, also useful, but they are apt to detract from the readability of a general history of our subject, and an essential element of usefulness of such a history is that it is actually read.

An important difference between the history by MONTUCLA and that by CANTOR is that pure and applied mathematics are considered by the former author while the latter confined himself to pure mathe-

matics. In the preface to the former work we are told that its author had also at first expected to confine himself to pure mathematics but decided to include the history of applied mathematics in order to reach a larger number of readers. He seemed to feel uncertain that this extension of the scope of his work, which was partly due to the advice of friends, was wise.

Both MONTUCLA and CANTOR treat not only the history of mathematics but also the history of some of the most noted mathematicians, and both authors aim to give clear explanations of the fundamental concepts whose history is presented as well as an outline of the political situations at the times when mathematical advances were made. The former of these features has been widely adopted even by authors of brief general histories of our subject. The latter feature has been less commonly adopted, but it is the more serious of the two, since it is becoming more and more easy to supply biographical information by means of general works of reference. On the other hand, it is becoming more and more difficult for the non-professional mathematician to secure a clear view of the fundamental elements involved in modern mathematical advances.

MONTUCLA laid great stress on securing clear ideas of the mathematical concepts before writing on their history, and it seems obvious that a reader cannot secure a deep insight into the history of any scientific subject without first acquiring a thoro knowledge of this subject itself. It is only then that he is in position to understand the significance of the various advances made at different times. This is especially true of mathematics in view of the interdependence of the different branches, and the fact that the more advanced theories cannot, as a rule, be understood without first mastering various special elements involved therein. Probably one of the main reasons why so few mathematicians are especially interested in the history of their subject is that they expect to be better prepared later to take up this subject.

A disadvantage of the types of treatments adopted by MONTUCLA and CANTOR is that such treatments require a large amount of space. For instance, if the material found in the recent second edition of CAJORI's *History of Mathematics*, 1919, were to be treated in this manner, twenty volumes would probably have been needed instead of the one in which we find it presented. It would evidently have been possible to restrict the number of topics treated and to present these few topics with full explanations of their mathematical significance and their historical

connections, but many readers doubtless prefer the « bird's-eye-view of the development of mathematics from its earliest beginnings to the present time », which the author aims to give here, even if many of the technical terms employed by him convey vague notions.

As a matter of fact we need different types of histories of our subject and it seems almost puerile to consider the question which type is the most important in a general way. The different types appeal to different classes of readers, and the healthy growth of our subject and its service to humanity as a whole demand that the needs of all of these readers should be met to the largest possible extent. The main question is whether a history is reasonably well suited to meet the needs of the class which it is intended to reach. Histories in which the reader is not expected to understand the mathematical significance of many of the concepts have the advantage of brevity and of freedom to read lightly or more seriously as one may desire. If the question, understandest thou what thou readest? were asked by a Philip of readers of such a history, various answers might be expected. Some might answer in the old familiar words, how can I except some man should guide me? Others might be inclined to reply, why should I try to understand? I am reading a history of modern mathematics. It is too much to ask one to study a subject and its history at the same time.

The reader of mathematical history who does not specialize along this line is usually not in position to verify many of the historical statements found in books on this subject, and hence he is naturally greatly interested in securing information relating to the relative accuracy of these books. It is therefore the more singular that in the past the accuracy or lack of accuracy seem to have effected only slightly the popularity of histories of our subject. For instance, F. HÖFER's *Histoire des Mathématiques* was first published in 1874. In the review of it which appeared in the *Jahrbuch über die Fortschritte der Mathematik* two years later, the reader is earnestly warned against the errors of this book. The nature of this review may be inferred from the following sentence which was printed in italics: « Errors of thought and type alternate so elegantly in this book that one must ask oneself whence the author has taken the little that is correct ». Notwithstanding this severe and deserved criticism, the book was reprinted at various times and reached its fifth edition in 1902.

Another singular fact is that even the best of the older general mathematical histories are now worse than useless for the beginner since they contain much that must be unlearned by those who read

them before they are acquainted with the discoveries of recent years relating to the history of our subject. The fact that we now know that many of the views held by leading mathematical historians fifty years ago are erroneous is not very encouraging if we can reasonably expect that those who will live fifty years after our times will discard many of the views which are championed by the mathematical historians of the present day. Fortunately this is not the case.

The fact that during the latter half of the nineteenth century the foundations of mathematics were re-examined and older views were subjected to severe criticisms may justify the hope that views on historical questions which stood the test of this age are not likely to rest on insecure foundations. It is, of course, to be expected that additional light will be thrown on many questions by later discoveries, but the fact that our mathematical historians are now confessing ignorance as regards such fundamental questions as when our common number symbols originated and why the circle was divided into 360 equal parts are hopeful signs. The praiseworthy attitude of many mathematical historians to weigh evidences and interpret facts will, however, probably always deprive this subject of the finality as regards reliability which is a property of most of the other mathematical literature.

To illustrate the difficulty encountered in weighing evidence we may refer to the statement that the Chinese seem to have known as early as 500 B. C. that $2^p - 2$ is divisible by the prime p in L. E. DICKSON, *History of the Theory of Numbers*, Vol. I (1919) p. 59. This statement is based upon a note written by J. H. JEANS and published in the *Messenger of Mathematics*, volume 27 (1898), page 174, where it is noted that this theorem is contained in a paper found among those of Sir THOMAS WADE and dating from the time of CONFUCIUS. It is difficult to determine how much weight should be assigned to such evidence in view of many unwarranted claims made by Chinese writers as regards historical questions, and the fact that the theorem does not seem to be in accord with the mathematical attainments of the Chinese at this early period.

The functions of the author of a mathematical history vary with the type of history he aims to produce. If this history is restricted to a comparatively small field, the main object may be to secure a complete list of the advances made in this field with indications relating to their nature and interrelations. As the field to be covered is enlarged and the amount of available space for details is decreased, the function of

the author becomes more and more judicial. In a brief general history of our subject the author is compelled to exercise the judicial function in the selection of his material as well as in the treatment hereof, unless his knowledge is so limited that he has enough space to say all he knows about particular subjects, which is unlikely. Perhaps the most difficult function of the author of a small history of our subject is that of a judge of relative values and the significance of particular developments.

It may be of interest to note here a few outstanding facts in regard to general histories of mathematics in the English language. The small number of such works and the small extent of those which have appeared tend to raise questions as regards possible explanations which do not reflect on the general mathematical interests of English speaking people. Each of these histories which first appeared in our language was confined to one volume and seems to have had for its main object a popular presentation of the principal facts relating to the history of our subject rather than a contribution to the knowledge relating thereto. Moreover, only smaller histories have been translated into English, beginning with the French work by BOSSUT which appeared in English in 1803.

Two modern English histories of mathematics which aim to cover the entire field are *A Short Account of the History of Mathematics* by W. W. R. BALL, first published in 1888, and *A History of Mathematics* by FLORIAN CAJORI, first published six years later. A fifth edition of the former appeared in 1912 and various corrections and additions were made, especially in the second edition, issued in 1893, but the fifth edition does not differ widely from the first. On the other hand, the second edition of CAJORI's work, issued in 1919, is about twice as large as the first and differs widely therefrom, especially as regards the treatment of the mathematical developments since the beginning of the nineteenth century.

BALL's *Short Account* was translated into Italian and enlarged by the translator, appearing in two volumes in 1903 and 1904. A few years later an enlarged French translation appeared also in two volumes. The first edition of BALL's book was quite unsatisfactory from a scientific standpoint as it was based largely on antiquated works. The later editions exhibit considerable improvement but even the fifth edition failed to embody some of the desirable changes to which attention had been called in the various reviews of this work. Its popularity seems to be due to its readableness rather than its accu-

racy. It contains a considerable number of biographical sketches of leading mathematicians of all times.

As the second edition of CAJORI's work is more recent it may be desirable to enter into somewhat greater details in its analysis. Its author added, soon after its publication, two pages, 515 and 516, devoted to additions and corrections. These naturally relate mainly to minor matters since the more serious desirable changes can usually not be properly treated in a few words. In fact, the latter often relate to incorrect impressions conveyed by various statements even when the statements taken separately are substantially correct.

As an instance of this kind we may refer to the following two sentences which appear on page 302 of the work under consideration. « EUCLID proved (I, 27) that — if a straight line falling on two other straight lines make the alternate angles equal to one another, the two straight lines shall be parallel to one another. — Being unable to prove that in every other case the two lines are not parallel, he *assumed* this to be true. »

The natural impression conveyed by these two sentences is that EUCLID proved the theorem mentioned in the former sentence without making the assumption to which reference is made in the latter. Such an impression is incorrect and is the more unfortunate since it is related to a fundamental fact in the history of elementary geometry. EUCLID proved this theorem by first assuming its converse and this converse is practically the assumption to which the second sentence refers. Each of the two sentences quoted above would be correct, with the exception of an obvious misprint, if it were placed in its proper environment, but as these sentences stand in the text they are apt to convey a very unfortunate impression.

It is the impression conveyed by a number of sentences or by whole pages which is the most important element of a history of mathematics, and if such a history is largely made up of statements taken in substance from various sources without being fully digested it is very apt to convey more false impressions than the actual inaccuracies in individual sentences would seem to indicate. In view of the great variety of subjects covered in a history of modern mathematics, it seems almost inevitable to introduce to some degree false impressions into such a history even when each statement taken by itself is practically correct.

The reader who realizes this difficulty can use to great advantage a work which otherwise might be harmful to him. For instance, if such

a reader finds the following statements, on page 325, « what is a curve? CAMILLE JORDAN in his *Cours d'analyse* defined it tentatively as a *continuous line* », he realizes that this cannot be meant as an actual definition. On reading further he will find various interesting and useful statements about curves, with proper references. While he may feel that the subject should have been presented in a much clearer way, even in the very limited amount of space devoted thereto, he must admit that many of the important elements of the history of curves are actually noted.

Perhaps one of the worst instances where false historical impressions are apt to be conveyed is found on page 131. In speaking about Germany it is here stated that « she produced REGIOMONTANUS, COPERNICUS, RHETICUS, and KEPLER, at a period when France and England had, as yet, brought forth hardly any great scientific thinkers ». The natural inference from this statement is that Germany made important scientific progress at an earlier date than France and England, while the reverse is actually the case. In particular, ROGER BACON was scientifically active and antedated all of those named above, and the mathematicians of France and England who belonged to no later period than KEPLER include VIETA, ORESME, NAPIER, BRIGGS, and many others.

Another instance where the reader who is not well informed as regards mathematics is apt to be misled in regard to a fundamental matter is found on page 164, where the following sentence in regard to a method used by FERMAT appears : « The main difference between it and the rule of the differential calculus is that it introduces the indeterminate quantity ϵ instead of the infinitely small dx . » Little lower on the same page we read that « FERMAT introduced the conception of infinitely small differences between consecutive values of a function ».

As there is no essential difference between FERMAT's method and our modern method of finding the derivative, except as regards notation, the reference to the indeterminate ϵ and the infinitely small dx is misleading, especially since this ϵ is implied to be infinitely small in the second quotation just noted. As these remarks relate to fundamental questions in the differential calculus where the progress of the student is so apt to be retarded by slight misconceptions, it is especially important that clear statements relating thereto should have been made.

It is not our purpose in this brief analysis of the second edition of CAJORI's history of mathematics to direct attention to all the desirable

modifications which were not noted in the published lists of corrections. This edition is more accurate than the first edition was, and the popular style in which it is written will doubtless win for it many readers and secure for it a wide field of influence. Even the professional mathematician will find here much that should prove to be helpful and inspiring, and teachers of mathematics will find much that will clarify the historical notes found in their textbooks. The man who is mainly interested in the history of science as a whole and turns to a history of mathematics for the purpose of securing an insight into this particular part of the general history of science will find CAJORI's work especially useful for the purpose of obtaining a superficial but extensive knowledge of recent developments in mathematics.

The most noteworthy recent contribution to the history of our subject is DICKSON's *History of the Theory of Numbers*, the first two volumes of which appeared in 1919 and 1920 respectively ⁽¹⁾. This is a *reference* history on the subject treated as may be inferred from the following quotation found in the preface to the second volume : « what is generally wanted is a full and correct statement of the facts, not an historian's personal explanation of these facts. The more completely the historian remains in the background or the less conscious the reader is of the historian's personality, the better the history ».

These few observations relating to types of mathematical histories and to a brief analysis of a few of the most popular general histories of mathematics are intended to be useful to the historian of science in general rather than to the specialist in mathematics. They may serve to emphasize the fact that mathematical history is still in a somewhat primitive condition, especially in the English language, and that more work along this line is highly desirable. They are also intended to aid in creating a more critical attitude as regards the popular general histories of mathematics in the hope that such an attitude may lead to improvement.

G. A. MILLER.

(University of Illinois).

⁽¹⁾ See *Isis*, III, 446 ; IV, 107.

Henrik Harpestraeng

A Danish Salernitan

Very few names of mediaeval Danish medical men are left, and the lives, writings, and titles of these are completely unknown in nearly all cases, as are the dates of their births and deaths. Various notes taken from religious and medical manuscripts acquaint us with their existence. A small number of medical texts are, to be sure, available, but, since they are anonymous, further investigation will be necessary before their authorship can be determined.

Even the most prominent of these mediaeval authors, HENRIK HARPESTRAENG, is rather unknown. PONTOPPIDAN (*Annales Ecclesiae Danicae* I, 636) quotes his funeral inscription, which is said to have been in the cathedral at Roskilde, in this way: *Non. Apr. Obiit Magister Henricus Harpestraeng, huius ecclesiae canonicus, MCCXLIV, qui multiplices eleemosinas huic ecclesiae contulit, tam in morte quam in vita sua*; and from another source (HANSFOT, *Script. Rer. Dan.* I, 288) we know that he died on the *IV Nonas Apriles*. The exact date of his death will therefore be April 2, 1244. On the year of his birth, however, it is possible to get only an indirect statement, which will be given later on. Two manuscripts (old royal collection (G. K. S.) 3639, 8*) of the Royal Library of Copenhagen and Codex Grensholmensis (vid. KLEMMING: *Lake och örteböcker*, p. 499) date from the xvth century and state: « This is the medicament, which HENDRIK HARPESTRAENG gave to King ERIC ». This king (1241-1250) was the son of WALDEMAR the Victorious and BERENGARIA, and these citations contain the only items we have on the learned canon and doctor.

His works are to be divided into (1), astrological and prognostical papers, among which are found some indications for venesection, written for King ERIC; (2), herbals; (3), hygienic, diagnostic and surgical papers; and (4), a manual of treatment, arranged *a capite ad calcem* (which seems with great probability to be attribu-

table to HARPESTRAENG). All these texts exist only in Scandinavian languages, six of them in Danish, one in Norwegian dialect, four in Icelandic, and nine in the Swedish tongue, but further information about them will not be given here, as all these questions are amply treated in the excellent work of Mr. M. KRISTENSEN, which will be mentioned below.

It is no wonder that the mediaeval author of so great a literary production has been studied for years. The first edition was made by C. MOLBECH (1826). Though the title was HENRIK HARPESTRAENG *Danske Laegebog*, the edition contained no manual of treatment, but simply one of the herbals, a book of stones, and a cookery-book. Modern critical researches have shown that these two last ones were written by another, unknown author. The Norwegian text is edited by M. HAEGSTAD (Christiania Vid. Selsk. Skr. 1906. Hist. filos. klass n° 2) under the title : « Et gammal-norsk Fragment av. H. H. ». Some of the Icelandic texts have a very skillful editor in H. KAALUND. (Köbenhavns Vid. Selsk. Skr. 6 R. Hist. filos. Afd. VI, 4 *Alfraedi islenzk*, I, 1908). To these Icelandic texts one more is to be added. It was lately found in Dublin (Royal Irish Academy n° 23, D. 3), is in 4° and written at the beginning of the xvth century. It is still unedited, but an edition is in preparation. The Swedish texts were reviewed by G. E. KLEMMING in his remarkable work : *Läke-och Orteböcker från Sveriges Medeltid*, Stockholm, 1883-1886.

A new period in the HARPESTRAENG investigations commenced with the splendid edition, made by Dr. MARIUS KRISTENSEN, the title of which is : HARPESTRAENG. *Gamle Danske Urteböger, Stensböger og Kogebøger*, København, 1908. As will be seen, HARPESTRAENG's name is here used as a collective word, because the edition comprises not only those texts which with certainty may be attributed to him but also the old Danish stone-books and cookery-books. Dr. KRISTENSEN's book is remarkable because the modern philological method is for the first time applied, and ample information is given, not only about the different manuscripts, but also about their inner relations and about the place of HARPESTRAENG in the system of medical history. The edition is so elaborate that it satisfies all wants, but it has not yet been completed.

We have seen that HARPESTRAENG's manuscripts have until now been found only in Scandinavian libraries — with one single exception (Dublin). But the learned author might possibly be found outside these countries, if his Latin name were to be discovered. It would,

moreover, be a very curious thing if his works had been written only in Northern languages, without any Latin model or original form. Now the writer of these lines, J. W. S. JOHNSON, has found in a manuscript in the royal library of Copenhagen (G. K. S. 1634. 4º) a couple of Salernitan texts, and, between them, one with the title *De simplicibus medicinis laxativis*, written by a certain HENRICUS DACUS. A comparison with the text of HARPESTRAENG made it evident that a Latin translation of the 81st chapter of the herbal had been found, and it was later on edited. (HENRICUS DACUS [HENRIK HARPESTRAENG] : *De simplicibus medicinis laxativis*, udgivet for første Gang af J. W. S. JOHNSON, Köbenhavn, 1914. French translation in *Janus*, 1917). The Latin name of HARPESTRAENG being thus found, one had new possibilities of learning more about his life in foreign manuscripts. And, really, he does not seem quite unknown abroad. The ms. fr. 1357, 2vº (XV s) of the imperial (now national) library in Paris contains SYMON DE PHARES : *Recueil des plus célèbres astrologues et de quelques hommes doctes*, in which a certain « maistre HENRY de Danemarche » is mentioned, and it is said there that he was a famous doctor in Orléans and a great astrologer who made many predictions. He is also said to have lived in that town during the reign of King PHILIPPE AUGUSTE (1165-1223) and, more exactly, in 1181. The identity of HENRICUS DACUS (HENRIK HARPESTRAENG) and HENRI de Danemarche is almost a certainty, because different facts substantiate it and because the city of Orléans was preferred in the Middle Ages by Danes who studied abroad. Since Danes were enrolled at foreign universities when they were about twenty years old, the year 1181 gives us indications from which the year of his birth may be approximated.

The Latin text mentioned has been discussed from different points of view. The editor of it believes it to be a part of an original model, which was later translated into the Scandinavian tongues. M. KRISTENSEN thinks it is a work from HARPESTRAENG's younger days. But whether it is one or the other, the text points towards Salerno and indicates, in different phrases, that we have before us the fragments of a lecture.

HARPESTRAENG was no original author. His book is built up from different sources, all Salernitan. The most prominent of these are MACER : *De viribus herbarum* and CONSTANTINUS AFRICANUS : *De gradibus liber* and *De chirurgia*. The Latin text is written over citations from AVICENNA, COPHO and SALADIN.

The HARPESTRAENG studies have not yet come to an end. A. CLÉMENT

and M. KRISTENSEN have written about a remarkable stone-name used in the stone-book. (*Et mærkeligt Stennavn hos H. H., Danske Studier*, 1917) and P. HAUBERG has shown, by examining manuscripts, also from later periods than the Middle Ages, that many fragments were yet to be found, which surely were to be ascribed to the learned canon and doctor. The paper has been included in the periodical just mentioned (*Lidt om HENRIK HARPESTRÆNG Lægebog*), and it teaches us that HARPESTRÆNG served as a model for several later medical works, especially those of CHRISTIAN PEDERSEN and HENRIK SMID.

(Copenhagen.)

J. W. S. JOHNSON.

Note on the Fahrenheit scale

We propose in this note to re-examine the question, how FAHRENHEIT came to adopt the graduation of his thermometric scale and also to consider the question whether he held the zero on his scale to be an absolute zero.

The only publications due to GABRIEL DANIEL FAHRENHEIT are five short articles, in Latin, dated 1724, and published in the Philosophical Transactions of London (1).

In the first article he gives the boiling points and specific gravities of five liquids; he says that water boils at 212° . Reference to his thermometers is made in the following passage:

I. « Moreover, the above experiments have not been made at the same time, hence the liquids would have been subject to different degrees of heat; as, however, the (specific) gravity varies in a different manner and unequally, I calculate their gravity at 48 degrees (a place which on my thermometer is exactly half way between the lowest point of severest cold (*intensissimi frigoris*) as obtained by mixing water, ice, sal ammoniac or sea-salt, and the degree of heat found in the blood of a healthy person). »

In his second paper FAHRENHEIT says:

II. « I manufacture two kinds of thermometers, the one kind is filled with spirit of wine, the other with mercury. Their length varies according to the use to which they are put. But all have this in common, that they agree in the number of degrees and vary between fixed limits. The scale of the thermometers serving merely meteorological purposes, begins with 0° and stops at 96° . This scale rests upon the

(1) *Philos. trans. of London*, Vol. 33, for the years 1724 and 1725, London, 1726. First article page 1-3. Second article, p. 78-84. Third article, p. 114-118. Fourth article, p. 140-141. Fifth article, p. 179-180. These articles are republished in German translation in OSTWALD'S *Klassiker der Exakten Wissenschaften* N^o. 57, 1894.

determination of three fixed points which are determined as follows : The first lies at the lowest part or at the beginning of the scale, and is found by a mixture of ice, water and sal ammoniac or also sea-salt ; if the thermometer is placed in this mixture, then the liquid falls to the point marked 0. This trial succeeds better in winter than in summer. The second point is obtained, when water and ice are mixed without the aforesaid salts; when the thermometer is dropped into this mixture, the liquid stays at the 32nd degree, and this point I call the point of initial freezing, for stagnant water is covered with a layer of ice when in winter the thermometer-liquid reaches this degree. The third point lies at the 96th degree ; and the spirit expands thereto when the thermometer is placed in the mouth or under the arm-pit of a healthy person and is kept there long enough to fully reach the temperature of the body... The scales of thermometers to be used in determining the boiling points of liquids likewise begin with 0, but stop at 600 degrees, for at about that temperature the mercury (with which the thermometer is filled) begins to boil. »

FAHRENHEIT's only other reference to his thermometric scale is in his fifth paper :

III. « In my account of experiments on the boiling point of several liquids, I mentioned that at that time the boiling point of water was found to be 212° ; later I recognized through various observations and experiments that this point is fixed for one and the same weight of the atmosphere, but that, for different weights of the atmosphere, it may vary either way ».

Deductions :

- a). From quotation I it follows that the two fixed points chosen for the thermometers which FAHRENHEIT described in 1724 were those of the ice-water-salt mixture and of blood temperature, and that the interval between them was divided into 96 steps.
- b). From quotation II we see that FAHRENHEIT (unlike other experimenters) had also a third point, determined by an ice-water mixture. We conjecture that this third point answered the purpose of more carefully comparing and checking the graduations of thermometers.
- c). Quotations I, II, and III lead to the conclusion that the boiling point of water was not used by FAHRENHEIT as a fixed point in the graduation of the thermometers described in his papers, that, in designing the thermometers which he used in determining boiling points, the 96 degree scale, above referred

to, was extended by equal steps on the stem of the thermometer and that, after the graduation was thus completed, FAHRENHEIT found by experiment that the boiling point of water fell at 212°. The number 212 was, therefore, not pre-arranged; boiling water simply *happened* to raise the mercury column to that point. If our interpretation is correct, then it was equally a matter of chance that, in the thermometers described in 1724, 32° came to mark the freezing temperature of water and that 180 came to stand for the number of degrees between the freezing and boiling points of water. We would expect that in his later practice, FAHRENHEIT would profit by the results of his experimentation, that he would discard the two fixed points mentioned in quotation I and choose the freezing and boiling temperatures of water as more convenient fixed points. But we possess no direct and reliable information that either he or his Amsterdam partner, PRINS, actually took this step.

Unless there are weightier reasons than mere guesses or conjectures (no matter how brilliant and tempting the conjectures may seem), it is not safe for a historian to depart widely from the obvious and direct consequences of statements made by an author. A violation of the rule has led to claims relating to the FAHRENHEIT scale that are most probably wrong.

For example, POGGENDORFF ⁽¹⁾ mentions a writer who expressed the opinion that though FAHRENHEIT does not claim to have used the boiling point as a fixed point in the graduations described in 1724, he nevertheless actually did use it along with the freezing point of water. Guesses of this sort are hazardous.

Again, ROSENBERGER ⁽²⁾ states, without giving any facts to support him, that FAHRENHEIT fixed on his thermometer stem the salt-ice and the water-ice points; then divided that interval by continued bisection into 32 parts, that thereupon the continuation of those divisions, yielded 96 as the temperature of blood. This interpretation does violence to FAHRENHEIT's statement as given in Quotation I, and does not fit the description found in the *Acta Eruditorum* for the

(¹) J. C. POGGENDORFF, *Geschichte der Physik*, Leipzig, 1879, p. 520.

(²) F. ROSENBERGER, *Geschichte der Physik*, Vol. II. Braunschweig, 1884, p. 281. J. C. FISCHER, *Geschichte der Physik*, Vol. III, Göttingen, 1802, p. 222.

year 1714, of two thermometers which FAHRENHEIT donated to CHRISTIAN WOLF. That description is in part as follows ⁽¹⁾ :

« The entire scale is divided into 26 equal parts, of which each is subdivided into fourths. Very great cold (*frigus vehementissimum*) is written at the second division from the cylinder, and from it ascending toward the end of the scale there are marked off 24 degrees, of which the fourth indicates great cold, the eighth cold, the twelfth moderate, the sixteenth hot, the twentieth very hot, the twenty-fourth unbearably hot (*aestum intolerabilem*). »

According to this account the interval from ice-water-salt to blood temperature was first subdivided by FAHRENHEIT into 24 parts, then each of these into four smaller quadrants, making 96 parts in all. This statement is confirmed by Professor CHRISTFRIED KIRCH of Berlin who in 1737 gave the following information ⁽²⁾ :

1. My thermometer, which I have used several years, was made by the so skilful FAHRENHEIT more than twenty years ago. On it 24 degrees of heat are numbered ; 0 denotes the greatest cold and 24 the highest heat. Two more degrees are introduced below zero, so that the degree of cold of the thermometer can be reckoned even when, in the case of extraordinary cold, its fluid contracts so as to withdraw below the limit zero.

2. This is a thermometer of small or medium size ; its scale measures 3 Rhenish inches from 0 to the 24th degree. The single degrees are divided into four quadrants, so that from degree zero to the last division line there are 96 quadrants.

3. On the newer FAHRENHEIT thermometers the scale is no longer divided into 24 degrees and quadrants, but into 96 smaller degrees, corresponding to the 96 quadrants of the 24 degrees in which the older thermometers are divided.

4. Some years ago I noticed that my thermometer did not entirely agree with others of FAHRENHEIT, and so I ordered from the famous Mr. FAHRENHEIT a new and exact thermometer, so as to be able to compare with it my own and other thermometers. I found that this new thermometer agrees well with others of FAHRENHEIT, but differs noticeably from mine.

⁽¹⁾ *Acta Eruditorum*, Leipzig, 1714, p. 381.

⁽²⁾ *Miscellanea Berolinensia*, T. VI, printed 1740. We take this quotation from W. J. FISHER's article « The Relation of RÖMER and FAHRENHEIT to the Thermometer » in *School Science and Mathematics*, Vol. 18, 1918, p. 648.

Thus both WOLF and KIRCH corroborate FAHRENHEIT's statement of the graduation of his thermometers.

As a third historical error, we refer to E. GERLAND's ⁽¹⁾ claim that the 96 degrees of FAHRENHEIT's smaller thermometer is an adaptation of the scale in Florentine thermometers, which indicated 16° when the weather was coldest, and 80° when exposed to the summer sun. But the 16° were positive, hence the interval was 80°—16°, not 80°+16°. The quotations we made from WOLF and KIRCH show that with FAHRENHEIT the 96 was reached by the route of 4 times 24.

Fourthly, in the article « Thermometer » in the *Edinburgh Encyclopaedia* (Philadelphia, 1832), PETRUS VAN MUSSCHENBROEK ⁽²⁾ is quoted as authority for the statement that FAHRENHEIT placed the highest point of the scale at the boiling point of mercury and then divided the space between that and his zero into 600 equal parts. A similar statement is found in CHARLES HUTTON's *Mathematical and Philosophical Dictionary*, 1793. These claims are at variance with FAHRENHEIT's own statements regarding his primitive fixed points.

Fifthly, A. J. VON OETTINGEN ⁽³⁾ asserts that FAHRENHEIT was the first to construct mercury-in-glass thermometers, but such thermometers were made earlier by the Parisian astronomer ISMAEL BOULLIAU (1639) and by others.

Lastly, POGGENDORFF ⁽⁴⁾ speaks of « die Temperatur des vermeintlichen absoluten Nullpunkts von FAHRENHEIT ». Did FAHRENHEIT consider his zero absolute? His reference in our quotation I, to a temperature *intensissimi frigoris* is not conclusive; does he mean the most intense cold *actually attained or ever attainable*? Most probably the first, for: (1) in his fifth paper FAHRENHEIT marks 96° on his scale « extream hott » and 0° « extream cold »; he knew « extream hott » could be surpassed upward, hence, probably, he did not consider « extream cold » to be unsurpassable downward. (2) The *frigus vehementissimum* on the FAHRENHEIT thermometers described by WOLF lends no stronger support to POGGENDORFF's contention. (3) On the

(1) E. GERLAND *Geschichte per Physik*, München and Berlin, 1913, p. 620.

(2) P. VAN MUSSCHENBROEK, *Essai de Physique*, Leyden, 1739, § 948.

(3) OSTWALD's *Klassiker* n° 57, p. 126.

(4) POGGENDORFF, *Geschichte der Physik*, p. 519. That FAHRENHEIT considered his zero to be absolute is stated also in REES' *Cyclopaedia*, article « Thermometer » and in other publications.

contrary, according to WOLF and KIRCH, the thermometers made by FAHRENHEIT contained one or two of the large twenty-four-step scale divisions, that were placed below the zero point, thus allowing for temperatures just below the FAHRENHEIT zero.

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Introduction to the History and Philosophy of Science

(Preliminary note)

Before leaving Belgium in October 1914, I had buried all my smaller notes in my garden. The rediscovery of these notes and of a good part of my library and of my larger notes, in August 1919, enabled me to resume at once the realization of an old design, namely, the writing of an introduction to the history and philosophy of science. Many months of the fall and winter of 1920 were almost entirely devoted to the reclassification of my material, and it was only on January 12, 1921 that I could begin the actual writing. I had at first thought that as soon as my material was duly classified, the writing would be relatively easy, for it is a fact that the Introduction exists potentially in my notes. Yet I discovered once more that there is a long, long way from such potentiality to reality. I am now publishing this preliminary paper because : 1. I realize that more time may elapse before the appearance of the Introduction than I had at first reckoned ; 2. To ensure greater completeness and accuracy I propose to submit parts of my work as soon as they are ready, to various specialists : this note will explain my purpose to them more fully than I could do it in a letter.

This preliminary note is divided as follows : (I) Purpose ; (II) Plan ; (III) Tentative Table of Contents ; (IV) Method.

I. — PURPOSE.

The fundamental purpose is to establish the history of science as an independent and organized discipline. The lack of organization of these studies is but too painfully obvious. The number of men professionally engaged in them is so small that it can be counted on both hands, and most of them are concentrating their attention upon a particular science or group of sciences. There are no textbooks above the elementary grade and hardly any of the intellectual tools without which research is necessarily very slow. The greatest number of scientists and scholars have not yet understood, — I do not say the importance of these studies, but their mere possibility ; they have

not yet admitted their very right to exist. Even when courses on the history of science have been organized in a few of our universities or colleges, the very way in which this has been done, suggests an utter misunderstanding of the question. A university president who would invite a professor of botany to teach Greek history would, of course, make a fool of himself, but nobody laughs when he asks the same professor to extemporize a course on the history of science. Yet the latter undertaking, in the absence of the proper tools, is one of great risk and difficulty, while the existence of many excellent textbooks (each being the result of a long, progressive evolution) makes it relatively easy to prepare a course on Greek history. I do not hesitate to say that albeit I have devoted the best part of my life to the study of the history of science, I would find it much easier to give an accurate (if not original) account of Greek political history, than of the development of science. In the first case indeed, I could at once take full advantage of the labour and of the accumulated experience of hundreds of scholars, in the latter case, on the contrary, I would be largely thrown upon my own resources.

Among the scientists and scholars who have become sufficiently interested in our studies, very few seem to have appreciated their special difficulties, which arise from their involving at every step a sound knowledge of two distinct sets of facts : scientific facts and historical facts, and a sufficient familiarity with the methods required to ascertain and interpret these two kinds of facts. The method of the history of science is a combination of the scientific and historical methods. Scientists are apt to underestimate the mere historical difficulties ; historians, to misunderstand the scientific data.

To establish the history of science as an independent discipline, our first step must be to define these studies, to explain carefully the knowledge they imply, the methods which must be used to promote them and finally to take stock of what has already been done and draw attention to that which remains to be done. My Introduction will be such a preliminary survey. It will contain also a summary of the history of science in general and of the history of each science in particular. It will deal chiefly with the development of pure sciences and only subsidiarily with their applications ; for one thing, the number of fundamental principles is limited while the number of applications is unlimited, and we must keep within reasonable bounds. Hence all the most important scientists will be included in the survey, while most educators, administrators, physicians, engi-

neers, inventors will of necessity be neglected. The most important scientists in our eye are those whose discoveries were more original and fundamental, and oriented scientific thought in a new way or enlarged its horizon. It is of course impossible to make a selection upon which all will agree, but I am taking great pains to realize as objective and comprehensive a choice as possible.

The history of science is not simply important in itself, as the history of one of the highest of human activities, but even more because it is the natural basis of the philosophy of science, and indeed of any positive philosophy. To be familiar with the latest stage of knowledge is insufficient for all but merely technical aims : it is impossible to appreciate the pregnancy of that knowledge unless we know its evolution, and unless we be able to place it in its proper historical as well as in its proper scientific background. From that point of view, it is clear that the history of science is even more significant than the history of religion or the history of art, which have long enjoyed full recognition as separate branches of learning and have reached a high degree of organization. For as soon as we realize that our knowledge of nature and of man can not be complete unless we combine historical with scientific information, the history of science becomes, so to say, the keystone of the whole structure. But it is safe to add that the number of scientists and historians who have fully realized that, is exceedingly small.

The aim of the Introduction is to give a complete proof of these assertions, to make a preliminary survey, to provide the student with a synthetic bibliography of the whole field and a master key to its problems.

II. — PLAN.

The Introduction is divided into two main parts, of which the first is devoted to the History and Philosophy of Science as a whole, the second to the History and Philosophy of the special sciences and of their branches.

The First Part in its turn is divided into three main sections : the first deals with generalities ; the second is a survey of the work accomplished at certain epochs or by certain racial or religious provinces of humanity ; the third, a survey of scientific progress, century by century.

The Table of Contents quoted below gives all the information that is needed on the first section. Neither does the second section call for much explanation. Its various chapters are devoted each to one

of the great periods of history (prehistoric times, antiquity, Babylonia, Egypt, Middle Ages) or to one of the great groups of men (primitives, Chinese, Mohammedans, etc.,) whose activity requires independent study, either for philological or for other reasons. For each of these chapters I will try not simply to give the synthetic bibliography but also to explain the specific methodology of the subject. It is plain that one can not undertake a study of, say, Mediaeval or Chinese science without undergoing a certain preparation and becoming acquainted with new methods and points of view. Of course these chapters are written primarily for the historian of science. The one dealing with Islamic science, for example, is not written for the Arabic scholar, and I will assume that the reader either knows the Arabic language or does not wish to know it. Yet it is hoped that the average Arabic scholar, not specially familiar with science, will find in it a sufficient amount of fresh information, and possibly the suggestion of a new point of view. The same remarks would equally apply to the other chapters.

In the third section, by far the most extensive, I survey the development of science century by century. For each century, I first quote the main sources relating to the progress of every science and of science in general, then, taking one by one its main scientists, I give a brief account of their life and work, and name the best editions of their writings and the best biographies and commentaries. The selection will be of necessity more rigorous for the later centuries and especially for the nineteenth century because of the increasing abundance of discoveries. Scientists still living will be included if their main work was done before 1901. Down to the year 1501, all the main scientists of any real importance are included, but beginning with the sixteenth century, I consider only those whose activity was not largely restricted to one special science, the others being dealt with in Part II when I speak of the particular science which they cultivated. For example, PASCAL, NEWTON, GAUSS are considered in Part I, while COPERNICUS, VESALIUS, VIETE, HARVEY, ABEL will appear only in Part II. However, cross-references will enable the reader to survey with comparative ease, either the total progress accomplished in each century or the continuous development of each science throughout the ages.

The Second Part contains an introduction in which the great problem of the Classification of Sciences is studied under its historical and philosophic aspects, and then as many main sections as

there are main groups of sciences. I consider seven groups, but I do not attach much importance to this classification and it is quite possible that the editing of my notes will oblige me to change it. While the first part is of greater interest to historians, the second will probably appeal more strongly to scientists and philosophers. The Table of Contents gives its main divisions, and the subdivisions of one of its chapters.

III. — TENTATIVE TABLE OF CONTENTS.

FIRST PART.

The History and Philosophy of Science.

(A) Introduction :

1. Definition of Science. Its signification and limitations.
2. History of Science : definition ; aim and signification ; sources ; methods ; history of these studies ; their relation to other studies ; main sources of auxiliary studies.
3. Organization of Science : external, technical, internal. (cfr. *Isis*, I, 193). National and international organization.
4. Philosophy of Science.

(B) Development of Science at certain periods or by certain peoples.

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| 1. Introduction. | 10. Middle Ages. |
| 2. Prehistoric times. | 11. Asia. |
| 3. Antiquity. | 12. China. |
| 4. Egypt. | 13. India. |
| 5. Babylonia and Assyria. | 14. Japan. |
| 6. Old Testament Civilization. | 15. Iran. |
| 7. Greece. | 16. Islam. |
| 8. Rome. | 17. Israel. |
| 9. Byzantium. | 18. Primitive and popular Science. |

(C) Development of Science, century by century.

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|-------------------------|---------------------------------------|
| 1. Ninth century B. C. | 15. Sixth century. |
| 2. Eighth century B. C. | |
| | |
| 9. First century B. C. | 23. ⁽¹⁾ Sixteenth century. |
| 10. First century. | 26. Seventeenth century. |
| | 27. Eighteenth century. |
| 14. Fifth century. | 28. Nineteenth century. |

(¹) From the xvth century on, only general scientists are considered, but the special scientists dealt with in the Second Part are quoted.

SECOND PART

History and Philosophy of the particular Sciences.

(The subdivision of this second part is not yet entirely determined. The following order is given tentatively.)

Introduction, Classification of the sciences : History and discussion of the attempts to classify the sciences. Vanity but practical necessity of such efforts. The applied sciences are not disconnected from the pure sciences, but, as much as possible, the principles and applications of science are considered successively in the same chapter. However, applications based upon the principles of many sciences are dealt with separately (*ex. gr.* technology, medical sciences).

(A) Formal sciences (Knowledge of forms) :

1. Logic and Theory of Knowledge.
2. Mathematics (including the statistical method).

(B) Physical sciences (Knowledge of inorganic nature) :

1. Mechanics.
2. Astronomy.
3. Physics.
4. Chemistry.
5. Technology.

(C) Biological sciences (Knowledge of organic nature) :

1. Botany.
2. Zoölogy.
3. Anatomy.
4. Physiology.
5. Biology.

(D) Sciences of the Earth (implying a knowledge of both inorganic and organic nature) :

1. Geodesy.
2. Geography and oceanography.
3. Geology, mineralogy, palaeontology.
4. Meteorology and terrestrial physics.

(Nos. 1 and 4 might have been placed in group B; they have been placed here for the sake of completing group D.)

(E) Anthropological and historical sciences (Knowledge of man, past and present) :

1. Physical anthropology.
2. Psychology.

3. Archaeology.
4. Ethnology.
5. Sociology, jurisprudence and positive polity.
6. Economics.
7. History of civilization.
8. History of art.
9. History of language and literature.
10. History of morals.
11. History of religion.
12. History of superstition and occultism.

(In nos. 7 to 12, the word « history » has about the same sense as in the phrase « natural history ». It might be replaced by the word « science ».)

(F) Medical sciences :

1. Medicine (to be subdivided in many separate sections).
2. Pharmacy.

(G) Educational sciences (the methods of imparting and diffusing knowledge) :

1. Pedagogics.
2. Bibliography. Library science.
3. Museology.

(H) Philosophical sciences.

It would be too long to give the contents of each section of this Second Part. I will simply outline one of them, which may be taken as representative.

Mathematics.

(A) Introduction :

1. Definition of mathematics. Its relations to the other sciences and its main subdivisions.
2. History of mathematics. Its main sources and its history.
3. Organization of mathematics (*ex. gr.* : bibliography, encyclopaedias, main textbooks, institutes, teaching, congresses, national and international organizations).
4. Philosophy of mathematics.

(B) History of mathematics century by century.

1. For the early times down to the fifteenth century (incl.) this historical outline will be very brief and will consist chiefly in references to the paragraphs of the First Part dealing with mathematics and mathematicians.

2. The sixteenth century.
3. The seventeenth century.
4. The eighteenth century.
5. The nineteenth century.

(C) History of special branches or topics.

1. History of various branches and sub-branches, with critical bibliography of the main publications relative to each. For example : Arithmetic; Algebra; Geometry (elementary, analytical, descriptive, synthetic); Trigonometry, etc. Theory of groups, Theory of Numbers, Determinants, Combinatorial Analysis, Theory of Equations, Theory of Probabilities, Statistical methods, etc.
2. History of particular topics : Quadrature of the circle, special curves, imaginary elements, mathematical instruments and models, etc.

CONCLUSION

(A) The History of Science, an essential part of education.

(B) The Encyclopaedic point of view.

History of encyclopaedic endeavours.

(C) The New Humanism.

History of humanism. Reconciliation of the humanistic and the scientific attitudes. The New Humanism.

Indexes.

IV. — METHOD.

The main substance of the introduction is directly derived from the enormous amount of notes which, being driven by an insatiable curiosity, I have managed to take on practically every topic having any relation, however remote, with the history of science. Unfortunately many of these notes were written when I was still very immature and are, in their present form, of little value. Besides, before the war I had no access to as good a library as the one in which I am now privileged to work. Hence many of my pre-war notes, being either immature or second-hand, have to be corrected, completed, rewritten. However, they are very useful to me as finger posts, and my work would be less comprehensive without them.

The information derived from my own collections is completed by the systematic use of three other sources : in the first place, the

Widener library, whose treasures are as accessible to me as if they were my own and whose catalogue is almost perfect; in the second place, a few standard textbooks dealing with the history of particular sciences. However, this second source is distinctly of an auxiliary nature. I use it only to make sure that no item of any importance has been neglected. The total amount of the Widener collections and of mine is so great that the probability of my overlooking any important scientist is very small; moreover the amount of information I have on each of them — obtained so to say at random during many years of study — enables me to measure their relative importance in an objective way, (that being of course only a first approximation.)

Finally I propose to submit various chapters or paragraphs of the Introduction, as soon as they are completed, to experts and to ask for their criticism and advice: this will be my third source.

It will be noted that the simultaneous use of my own collections and of these three other sources must give to my selections a good deal of objective value. This is especially important in the present case, for the size of the subject naturally obliges me not simply to select the topics to be considered, but even for each topic, to select the information to be given. The bibliography to be truly synthetic (see *Isis* III, 139-170) must be critical and selective. I will eliminate the dead wood as much as I can and add critical appreciations as often as possible.

Neither will I hesitate to introduce eventually reflexions of a more personal vein. I will do this for I know by experience how such side remarks can be helpful sometimes even if they be a little adventurous: how often have I not wished that authors whom I was consulting had been less reticent! This can not jeopardize the objectivity of my work for the reader will always know when I am stating a fact and when I am simply expressing an opinion.

It is hardly necessary to add, that however much I may try, the various chapters or paragraphs of such a book are bound to be of very unequal value. I may spend so much time investigating the material pertinent to some of them, that the writing of a new monograph on the subject would cost me but little additional pains. For many others, I must needs rest satisfied with a far more superficial investigation, or else my Introduction would never be ready.

GEORGE SARTON.

(Cambridge, Massachusetts. May 23, 1921.)

The Principle of Symmetry

and

its applications to Science and to Art ⁽¹⁾

It is part of the purpose of *Isis* to draw the attention upon the process of organization or reorganization which science is constantly undergoing and which causes any attempt at classification of its branches to be extremely precarious. A reorganization may become necessary almost at any time, either by the discovery of a new cardinal fact, or by the introduction of a new fundamental method or by the extension of an old method to a larger field. F. M. JAEGER is professor of inorganic and physical chemistry at the University of Groningen and has made a special study of crystallography. His « Lectures on the Principle of Symmetry » are a good example of synthesis of the third kind, that is, resulting from the extension of an old method to new objects. He has thought wisely that the theory of symmetry which had proved to be such a powerful instrument of knowledge in a relatively small field should be systematically applied to the other branches of science. The results of his investigations are very encouraging and there is no doubt that it will be worth while to follow his trail.

But before examining his work, I must make another remark. The theory of symmetry is of special interest from our point of view because it carries us at once into the borderland between science and philosophy, and also between science and art; — if I may say so, into the very home of *Isis*! — By the way, it would be fascinating to retrace the development of the idea of symmetry from the Pytha-

(1) A propos of F. M. JAEGER's Lectures on the Principle of Symmetry and its applications in all natural sciences, XII + 333 p. Amsterdam, ELSEVIER; Cambridge University Press, 1917 (A second improved and augmented edition, XII + 348 p. has appeared in 1920) and subsidiarily of other publications by D'ARCY WENTWORTH THOMPSON, SIR THEODORE ANDREA COOK, JAY HAMBIDGE, DENMAN W. ROSS. My quotations have been made from the second edition of JAEGER's book.

gorean days down to our time. Such a study would enable us to make a master section through the whole history of scientific thought and would provide us with an excellent touchstone to appreciate the relations of science and art at various times. This examination would be very comprehensive, for it would take us into almost every department of knowledge; it would attract us into the workshops of the craftsmen as well as into the laboratories of the scientists; it would oblige us even to make a pleasant excursion in the realm of Chinese philosophy and aesthetics. Professor JAEGER himself might be tempted to carry on these investigations, and he would be doubly well prepared to undertake them ⁽¹⁾.

To come back to his Lectures, he has not tried to give us a complete account of the mathematical theory of symmetrical systems, as this has been done often enough, but he has simply summed up the main results of this theory, to refresh the reader's memory. After a brief introduction in which he proposes to call symmetrical figures « such as are similar to themselves or to their mirror-images » in more than one way », he devotes the four first lectures to a brief account of the general theory, applying it already as often as he can, to organic morphology. For example (p. 69-71) he shows how the biologist could avail himself of the principle of symmetry for the description of plants and of animals. HAECKEL tried to use this method in his *Systematische Phylogenie*, 1894, but failed partly because this theory was not sufficiently developed, partly because of his own ignorance. Chapters V, VI, VII deal chiefly with the more special theory of symmetry as applied to crystals, but incidentally with many other applications. For example in chapter V he answers the query : How is it possible to speak of the specific symmetry of a physical phenomenon, of a physical state, or of a physical medium ? Then apropos of the symmetry of cause and effect he reaches the very interesting conclusion (p. 93) : « the effects may have occasionally the same or a higher symmetry than the producing causes, but the last cannot have a higher symmetry than the effects observed ». In chapter VI, JAEGER considers the case of unlimited systems and discusses the various theories concerning the constitution of crystals, taking into account the new facts revealed by the use of RÖNTGEN-rays. He ends this chapter by examining similar periodical arrangements

(1) For his studies on the history of chemistry, see *Isis*, IV, p. 50, 83.

in living nature, — in particular, phyllotaxis. Then, comparing periodical arrangements in crystals and in plants, he concludes (p. 170) : « The essential difference between the two cases remains this, that all kinds of net-planes can with a greater or smaller probability of occurrence, have the function of crystal facets, while of all theoretically possible regular distributions of the loci of leaf-attachment in plants only those are realized by nature whose divergencies approach closely to those expressed by the fractions of the principal series, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, [the so-called series of FIBONACCI], or of series deduced from it in a simple way ». Chapter VII is devoted to a study of crystallographic aberrations — mimetic forms and apparent symmetry — and this enables the author to emphasize more strongly the contrast between organic and inorganic nature : (p. 202) « In living nature, there is a gradual evolution of forms from higher towards lower symmetry and a characteristic preference for the irrational ratio of the « aurea sectio »; in the inorganic world on the contrary, a tendency towards higher symmetry as to a condition of greater mechanical stability and the exclusion of all irrational ratios in the period of the symmetry-axes » (1). This contrast is very great but at the bottom it may be nothing but the obvious opposition between the tendency towards equilibrium (the growth of entropy) and the tendency towards ceaseless change, — or more briefly, the opposition between death and life. Indeed this contrast might be used to define life.

But we are not yet at the end of our study. Chapters VIII and IX

(1) It is well to substantiate this general statement with a few examples borrowed from JAEGER's book (p. 200) : (A). *Tendency towards a higher symmetry in the inorganic world*. (1) Apparent and mimetic symmetry in crystals; (2) polymorphic substances generally changing into higher symmetrical forms when temperature increases; (3) optical antipodes tending to pass into optically inactive systems; (4) when several isomerides may occur simultaneously, preferential formation of the more symmetrically built molecules (for ex. it is far easier to produce the threefold symmetrically substituted derivatives of phenols, anilines, etc., than their less symmetrical isomerides). — (B). *Tendency towards a lower symmetry in the living world*. (1) Lower animals show in many cases a much higher symmetry than the mere bilateralism of the higher animals; (2) pelories, that is abnormal regularity of structure occurring in normally irregular flowers : this phenomenon is generally explained as a retrogression towards an older and more symmetrical prototype.

As to the characteristic preference for the irrational ratio of the golden section, it will suffice to recall the frequent occurrence in the living world of pentagonal symmetry, — a symmetry unknown in the inanimate world.

deal with PASTEUR's discovery of the relation between enantiomorphism and optical activity and with the consecutive development of stereochemistry. PASTEUR was convinced that the production of single optically active substances was the prerogative of life ⁽¹⁾, and it is a fact that one has not yet been able to perform a total asymmetric synthesis directly (that is, without the presence of living organisms or of other asymmetric substances). JAEGER fully discusses this fundamental question, quoting and analysing all the relevant facts. The contrast between the living and the death world seems greater than ever : « The living world is *specific* in its dissymmetry and its dissymmetric specificity is of the highest nature ». This discussion is of course not new; as JAEGER recalls it (p. 301), a very interesting controversy on this very subject was started in 1898-1899 by JAPP's address to the British Association on « Stereochemistry and Vitalism ». E. FISCHER was the first to point out, in 1894, that the contrast between natural and artificial synthesis is not as absolute as PASTEUR believed it to be. Natural synthesis in the living organism takes place in a one-sided way, because it occurs under collaboration of optically active substances; moreover the one-sidedness may be due simply to the fact that natural synthesis can never lead to a state of completed chemical equilibrium, as the produced substances are gradually consumed by the organism; this one-sidedness is thus brought within the scope of chemical dynamics, being simply reduced to a difference in reaction velocities. If the one-sidedness of chemical reactions in living bodies is explained by the guiding influence of optically active substances, one must still explain how the first substance of this kind originated. A. BYK has tried to demonstrate that this original asymmetry in the living stuff was caused by a constant excess of circularly polarized light of a definite direction of rotation, but this seems to me a little adventurous ⁽²⁾.

* * *

(1) « Les produits artificiels n'ont donc aucune dissymétrie moléculaire; et je ne saurais indiquer l'existence d'une séparation plus profonde entre les produits nés sous l'influence de la vie et tous les autres... Il y a là des mystères, qui préparent à l'avenir d'immenses travaux et appellent dès aujourd'hui les plus sérieuses méditations de la science. » L. PASTEUR, 1860 (as quoted by JAEGER, p. 284).

(2) PASTEUR himself devised ingenious experiments to establish the chemical importance of the asymmetry of natural forces, but failed (See VALLERY-RADOT, *La vie de PASTEUR*, end of Ch. III).

It is interesting to note that during the last years, many men — of very various types — have devoted much attention to the study of symmetry. Unfortunately when a subject is as broad as this one, and located at the crossroads of many theories, when its study has not yet been standardized, it always happens that a great deal of the energy of the first investigators is misdirected and actually wasted by their ignorance or their extravagance.

This remark does not apply to D'ARCY WENTWORTH THOMPSON's excellent book on « Growth and Form », Cambridge, 1917, ⁽¹⁾ a very rich collection of facts cautiously selected and wisely classified. But it applies most decidedly to Sir THEODORE ANDREA COOK's extraordinary compilation, « The Curves of Life, being an account of spiral formations and their application to Growth in nature, to Science and to Art, with special reference to the Mss. of LEONARDO DA VINCI », London, 1914 ⁽²⁾. This book written by one of the most accomplished and learned dilettanti of our time, is a remarkable mixture of wisdom and eccentricity. It contains a very large collection of precious facts borrowed from the most heterogeneous sources, and the reader having enough knowledge and common sense to be protected against the fanciful theories of the author will find in it valuable material for his studies and much food for his thought.

The same remark applies also, I regret to say, to the very industrious and ingenious publications of JAY HAMBIDGE. These have attracted so much attention, both in America and in England, that I must say a few words of them ⁽³⁾. This author is chiefly concerned with the application of symmetry to art and he claims to have discovered in the Greek monuments of the best period a method of design which may be of great use to the modern artist. He has introduced

⁽¹⁾ Cfr. *Isis*, III, p. 128-129.

⁽²⁾ Cfr. *Isis*, III, p. 127.

⁽³⁾ *Dynamic Symmetry*, 15 plates and text which explain some of the more obvious principles of the areas used in Greek design, Boston, Moosehorn Printing Co., 1919. — *Dynamic Symmetry, the Greek Vase*. 161 p. 4°, Yale University, 1920. — JAY HAMBIDGE is the editor of *The Diagonal*, an illustrated monthly magazine devoted to the explanation of the rediscovered principles of Greek design, their appearance in nature, and their application to the needs of modern art. Vol. I, 1. Yale University, 1919 (no. 10 appeared in August 1920). I followed an interesting polemic on *Dynamic Symmetry* in the London Times, December 1919, January 1920; JAY HAMBIDGE stated his case very well on the 6th of January.

the terms « static » and « dynamic » symmetry to express the contrast between the relatively simple sort of symmetry obtaining in the inorganic world and the more subtle and fleeting symmetry of the living forms. By the way this contrast had already been well shown in another way, by Sir THEODORE. The readers of JAEGER's book or simply of my review of it, will understand the deep significance of this contrast. The origin of beauty in nature or in art is to be found in the presence (conscious or not) of the irrational symmetry of life, and HAMBIDGE's practical purpose is to give to the artist some simple means to realize mechanically this type of symmetry. So far, so good. Unfortunately the results of his investigations are explained in a mysterious language, obscured by the use of bad geometry and of unnecessary technical terms. It is probable however that it is partly because his « discoveries » have been covered by an air of mystery and rendered artificially far more abstruse than they are, that they have been so successful. Such is the fascination which an appearance of mystery, pseudo-knowledge and muddled thinking always exert upon an ignorant public. To them a theory seems more profound when it is less clear. HAMBIDGE's discoveries could be explained briefly and clearly in very simple language to any person having a sound knowledge of elementary geometry. They would then be less mysterious and attractive but far more useful. Of course they will never provide recipes for the making of masterpieces (HAMBIDGE himself does not make such foolish claim) but they will give to the artist a method of design which, if it be simple enough ⁽¹⁾, may be just as useful to him as, say, his knowledge of the principles of perspective. Or to use other comparisons, this method of design (or other methods similar to it ⁽²⁾), for we do not yet know which will triumph) may help the painter, the sculptor, the architect in the same way that the methods called harmony and counterpoint help the musician, or that the rules of prosody help the poet. All these methods, — that is, those systems of conventional rules, — are very useful even if they are not strictly abided by, for even when the artist chooses to stand at the outside he is still guided by them.

(¹) HAMBIDGE's applications of a sound general principle are already much too complex and farfetched. Artistic methods to be fertile must be very simple, so as to interfere as little as possible with free inspiration.

(²) For ex. DENMAN W. ROSS' ideas as explained in : *A Theory of Pure Design. Harmony, balance, rhythm.* Boston, 1907.

To sum up, JAEGER's and THOMPSON's books are contributions of great value. They help us to understand more clearly one of the greatest riddles of the universe : the nature of life. Besides, JAEGER's book will help us to apply the Principle of Symmetry to other scientific problems. It would be interesting to conduct similar investigations from the artistic point of view, for the consideration of symmetry throws as much light on the nature of beauty as it does on the nature of life. The studies published by Sir THEODORE ANDREA COOK and by JAY HAMBIDGE are certainly not lacking in originality and they are very suggestive, but on the whole disappointing. We feel cheated; the vision which these books suggested was so great, — and so little is left of it! Yet, this is only a beginning, and at any rate all these books help us to appreciate the fundamental importance of Symmetry, which has always been and will always remain one of the safest guides both of the scientist and of the artist.

GEORGE SARTON.

Notes and Correspondence

Encyclopédie des Sciences mathématiques pures et appliquées. —

J'ai déjà protesté avant la guerre ⁽¹⁾ contre la lenteur de publication de cette encyclopédie. Cette lenteur était vraiment excessive et témoignait d'un joli mépris des intérêts des souscripteurs. La publication a été entièrement interrompue pendant la guerre et après plus de deux ans de « paix » elle ne donne encore aucun signe de vie. En attendant, les malheureux souscripteurs (dont je suis, hélas!) se trouvent en possession de 32 fascicules — *disjecta membra* — qui sont les commencements de non moins de 17 volumes dont *aucun* n'est complet! Pour préciser ma critique je donne ci-dessous brièvement la liste des volumes entamés; on remarquera d'abord que les 4 premiers auraient pu être complétés assez rapidement, ce qui aggrave la faute des directeurs et des éditeurs; ensuite que la publication d'avant-guerre était déjà scandaleusement lente puisque le premier fascicule date de 1904!

Voici la liste :

I, 1. Arithmétique	4 fascicules, 1904-1909.
I, 2. Algèbre	id. 1907-1912.
I, 3. Théorie des nombres	id. 1906-1910.
I, 4. Calcul des probabilités.	id. 1906-1911.
II, 1. Fonctions de variables réelles	2 fascicules, 1909-1912.
II, 2. Fonctions de variables complexes	1 fascicule, 1911.
II, 3. Equations différentielles ordinaires	id. 1910.
II, 4. Équations aux dérivées partielles.	id. 1913.
II, 5. Développement en série	2 fascicules, 1912-1914.
II, 6. Calcul des variations	1 fascicule, 1913.
III, 1. Fondements de la géométrie	id. 1911.
III, 2. Géométrie projective	id. 1913.
III, 3. Géométrie algébrique plane	id. 1911.
IV, 1. Mécanique générale	id. 1912.
IV, 5. Systèmes déformables	2 fascicules, 1912-1914.
IV, 6. Balistique, hydraulique	1 fascicule, 1913.
VII, 1. Astronomie sphérique	id. 1913.

Ces fascicules contiennent évidemment des matériaux précieux et

(1) *Iris*, I, 256, 1913.

nombreux, mais tels quels, il est très malaisé de les utiliser, car aucun volume n'étant complet il est impossible de les faire relier. De plus quand il sera complet, chaque volume sera extrêmement hétérogène. car si récents que soient les derniers chapitres, les premiers seront déjà vieux de vingt ans. Espérons que tous ceux qui sont responsables s'efforceront de réparer ce gâchis aussi vite que possible. Il compromet sérieusement la bonne renommée des éditeurs scientifiques français.

G. SARTON.

Philip Lee Phillips' contributions to the bibliography of cartography. — Mr. PHILLIPS is not simply the chief of the Division of Maps of the Library of Congress in Washington, but its father, for he it is who organized it from chaos to its present condition of almost perfect order and availability. The map collection of the Library of Congress is certainly one of the richest (if not the richest?) in existence, and thanks to the untiring industry of its chief, it is probably the best classified and the best equipped to be found anywhere. On the basis of the immense amount of material systematically arranged by him, Mr. PHILLIPS has published a series of bibliographies which are by far the most extensive and the more elaborate of their kind. It is to him that the student of cartography owes his fundamental bibliographic tools. However Mr. PHILLIPS' activity and his publications have not yet received the full recognition they deserve and the purpose of my note is to try to make up, as far as it is in my power, for this injustice and to express publicly to him the gratitude and respect which any historian of science who knows his work, can but feel. It is easy enough to accomplish this purpose, for it will suffice to describe Mr. PHILLIPS' main publications; any but a very brief commentary would be superfluous. I will be able at the same time to give the reader some idea of the wealth of material — some of it, exceedingly precious — which is now available in Washington ⁽¹⁾.

Let us consider, in the first place, the most important of Mr. PHILLIPS' publications, that is, his monumental *List of geographical atlases in the Library of Congress with bibliographical notes*, 4 vol. Washington 1909-1920, about 3642 p. (Vol. I and II, 1909 form a whole; vol. III and IV are supplementary lists published respectively in 1914 and 1920.

⁽¹⁾ I extract the following data from the latest *Report of the Librarian of Congress*. Washington, 1920, p. 60. The Library at the date of June 30, 1920 contained : 158,369 maps, 5,448 atlases, 969 manuscripts, 1,662 views, that is 166,448 items, *not* counting the SANBORN insurance maps, the British Ordnance survey maps and the Egyptian survey maps, 302,662 in number.

The author list of vol. IV includes references to the 4 volumes, but the reader should consult 3 indexes, in vol. II, III and IV. These 3 indexes contain about 87,300 entries.) These volumes contain the titles of 5,324 atlases. « The arrangement starts with general atlases of special subjects, followed by general atlases of the world arranged chronologically. Following, come America, Europe, Asia, Africa and Oceanica. Included in the collection are the atlases of cities, those to accompany voyages of circumnavigation, historical works, scientific explorations and reproductions in atlases to accompany boundary disputes between nations ». The compilation of such a list is especially useful because a great number of the separate maps contained in the map collections are simply maps which have been « detached » from atlases, and which can only be identified with reference to their source. This is the more difficult that the maps show no indications of their origin on their face. On the other hand, old atlases frequently contain maps of various provenances which have been « inserted » by some former owner. It must be noted that old atlases rarely contain tables of contents and are rarely dated. Sometimes the date of dated maps has been erased by unscrupulous publishers that they may be sold again as new ones. For these reasons, Mr. PHILLIPS has taken considerable pains to make sure that the old atlases examined by him were complete, and he has given us complete descriptions of them, map by map. Historians will be glad to find in this list also elaborate descriptions of the collections of old manuscript or printed maps published by SANTAREM, JOMARD, FISCHER, MÜLLER, NORDENSKIÖLD and others. This is the more valuable that these collections of fac-similes are rare and expensive and that but few people have easy access to every one of them.

Among the atlases analyzed in this work one will find *ex. gr.* : 42 editions of PTOLEMY, of which 32 are previous to 1600; 62 editions of ABRAHAM ORTELIUS; 30 of MERCATOR; Sir ROBERT DUDLEY, *Dell' arcano del mare... libri sei*, 3 vol, in-2. Firenze, 1646-1647, the first marine atlas in which the maps were drawn on the MERCATOR projection (minutely described in vol. I, p. 203-217), also second ed., Firenze, 1661; CORNEILLE WYTFLIET, *Descriptionis Ptolemaicae augmentum*. Louvain, 1597 and 4 later editions, the earliest distinctively American atlas; JEDIDIAH MORSE, *American geography*. London 1794, containing the earliest maps of the states in the union; CHRISTOPHER SAXTON, *Maps of England and Wales*. London, 1574-1579, later ed. 1659-1689, the so-called Elizabethan atlas, the earliest survey maps of England and Wales; ANTOINE LAFRÉRY, *Geografia*. Roma, 1575 (?), described with copious bibliographical notes in vol. III, p. 81-92, also p. IV; WILLEM JANSZON BLAEU (1571-1638), *Flambeau de la navigation*,

Amsterdam, 1620, English ed., 1622; JOAN BLAEU (1596-1673), 12 atlases, chiefly his *Atlas Major*, 11 vol., Amsterdam, 1662-1665, containing 590 maps; the Library of Congress has another copy, partly of the same ed. dated 1662-1672, and also a copy of a Spanish ed. published in Amsterdam in 10 vol., 1659-1672. This Spanish ed. is very rare, as it was almost entirely destroyed by fire in 1672 (vol. III, p. 146-164; IV, p. 132-134); WILL. JANSZON and JOAN BLAEU, *Théâtre du monde*, Amsterdam, 1635, and 5 other editions; HENRICUS HONDIUS and JAN JANSSEN, *Nouveau théâtre du monde*. Amsterdam, 1639-1640; JAN JANSSEN (d. 1666), 11 other atlases; WILLIAM BERRY. A collection of 38 maps of the world, sometimes called the English SANSON atlas, London, 1680-1689 (only two other copies of this atlas are known); NICOLAS SANSON d'Abbeville (1600-1667). *Atlas nouveau*, 1689-1690, and 2 other editions, also 13 editions of other atlases; JOHANNES CÔVENS and CORNELIS MORTIER, *Atlas nouveau*, 9 vol. Amsterdam, 1683-1761, a magnificent set of 922 maps (vol. III, p. 192-223) and 5 other atlases, etc. The 1525 maps, plans and views contained in PIETER VAN DER AA, *La galerie agréable du monde*, 66 vol. Leide, 1729 are enumerated and indexed (vol. III, p. 288-324).

I must quote more briefly Mr. PHILLIPS' other publications, however important: *Maps of Alaska*, 1588-1898, 119 p., 1898; *A list of maps of America*, in the Library of Congress preceded by a list of works relating to cartography, 1137 p., 1901. [The bibliography of cartography covers 90 p.; Mr. PHILLIPS writes me that a new edition of this bibliography is ready in manuscript. This new work is arranged in dictionary form and includes 28,440 titles ⁽¹⁾]; *Maps of Cuba*, 61 p., 1898; *Foreign Government Maps*, 58 p., 1904; JUSTIN WINSOR, *The KOHL collection* (now in the Library of Congress) of maps relating to America, with index by P. L. PHILLIPS, 189 p., 1904; *The LOWERY collection*, descriptive list of maps of the Spanish possessions within the present limits of the United States, 1502-1820, by WOODBURY LOWERY. Ed. with notes by P. L. PHILLIPS; *Maps of Philippine Islands*, 1903; *Maps and views of Washington and District of Columbia*, 1900 (revised ed. ready in Ms.); *Notes on the cataloging, care and classification of maps and atlases...*, 20 p., 1915; *Maps of the world war*, 202 p., 1918. (All of the previously quoted publications are published by the Library of Congress and may be purchased at nominal prices from the Superintendent of Public Documents at Washington D. C.).

The following fac-simile editions are published by LOWDERMILK & Co., Washington D. C.: *Map of Virginia and Maryland*, by AUGUSTINE

⁽¹⁾ See: *Report of the Librarian of Congress for 1919-1920*. Washington, 1920, p. 61.

HERRMAN, 1673 (from the unique copy in the British Museum); JOHN FILSON's *Map of Kentucke*, the first map of Kentucky, 1784; JOHN FITCH's *Map of the Northwest*, 1785; MANASSEH CUTLER's *Map and Description of Ohio*, 1787.

Mr. PHILLIPS has published himself a book of halftone reproductions of rare views with notes, entitled : *The beginnings of Washington* as described in books, maps and views, and he has completed in manuscript various other compilations : *Maps of California and San Francisco to 1865*; *Maps and views of New York*; *Maps and views of Philadelphia*; BERNARD ROMANS, his biography and bibliography with a reproduction of the « Two whole sheet maps » of Florida, 1775; *The first map and description of Tennessee*, by General DANIEL SMITH [1795?].

It is very desirable that the still unpublished lists of Mr. PHILLIPS may be published as soon as possible, for they are of great importance. Of course, it is to be hoped that sooner or later his purely bibliographical descriptions will be supplemented by others based on a deeper study and comparison of this enormous mass of material, — that is, that Mr. PHILLIPS' *analytic bibliographies* will be completed by *synthetic bibliographies* (*Isis*, III, 159-170), in which the essential be put in the limelight and the superfluous, dropped, — but even when such indispensable synthesis be perfected, Mr. PHILLIPS' compilations will still retain their fundamental value.

G. SARTON.

Hans Peder Steensby (1875-1920). — HANS PEDER STEENSBY was born on the 25th of March, 1875, in a little town, Steensby, on the island of Fyn, Denmark. His father was a farmer named JENS HANSEN. Because he was born in poor circumstances, he received aid from different people in the town who thus enabled him to go to the university of Copenhagen. He there passed his examen as *candidatus magisterii* in 1900. He studied from 1904 to 1906 at the Berlin university, taking his degree as Doctor of Philosophy in 1905 with a very remarkable book *Om Eskimokulturens Oprindelse*, 1905 (On the origin of the Eskimo-culture). This book was later on much discussed because it in different places advanced quite new points of view. STEENSBY then took up the study of Danish anthropology, and set forth his results in *Foreløbige Betragtninger over Danmarks Raceantropologi. Meddelelser om Danmarks Antropologi*, 1907 (Preliminary considerations on the anthropology of races in Denmark). Following ethnographical pursuits he travelled in 1908 in Algeria and Tunis (see *Geografisk Tidsskrift*, 1908-1910), in 1909 to West Greenland and Cape York, and in 1910 through Egypt, British Soudan and parts of Palestine and Arabia. His explorations in Greenland having given great results, he edited *Etnografiske og antropogeografiske Rejsestudier i Nord-Grøn-*

land 1909. *Meddelelser om Grönland*, I, 1912. (Ethnographical and anthropo-geographical studies on a voyage in Nord-Greenland) and later an *Anthropo-geographical study of the origin of Eskimo Culture*, 1916 (*Meddelelser om Grönland*, LIII).

In 1911 he was named professor of geography at the university of Copenhagen, a few years after which the geographical instruction was completely reorganized, when he started a laboratory which included a great library for the students, and a museum. He then took up the study of geography on a historical basis, showed in a very elaborate paper that PYTHEAS of Massilia had travelled along the westcoast of Jutland and had given a description of it (*Geografisk Tidsskrift*, 1916), and explained in *The Norsemen's route from Greenland to Wineland*, Copenhagen 1918, what was meant by the different geographical terms used by the ancient saga-writers, and in what way they had gone to America. This book was for European geographers an event, for it undoubtedly gave the solution to a much discussed problem. The one thing lacking was a practical confirmation of his theories; he therefore in 1920 went to America, traversed it from South to North, and visited Wineland. On a postal-card which I received a day before the arrival of the telegram which announced his sudden death, he stated that he was without doubt about where the different countries of the sagas are to be found. In letters to other friends he has given more detailed statements, which I have not yet seen.

STEENSBY was among the best of European geographers, and his sudden death, from apoplexy, was a great loss not only to our university but to science.

(Copenhagen.)

J. W. S. JOHNSON.

The organization of research in the history of technology on a commercial basis. — I have already devoted a note to the activity of Mr. FRANZ FELDHAUS and of the count KARL VON KLINCKOWSTROEM in the *Revue générale des Sciences*, t. XXIII, p. 421. Paris, 1912. There is no use repeating what I said there and then, but I wish to complete and correct the information which I gave. For one thing the great encyclopaedia on the history of technology which was to appear in 1918 (?) has not appeared. Of course, the war happened, and maybe Mr. FELDHAUS realized after a while that his former plans were far more ambitious than he could realize at the beginning: that is a common experience. But Mr. FELDHAUS published in 1914 an excellent book entitled *Die Technik der Vorzeit, der geschichtlichen Zeit und der Naturvölker*. Ein Handbuch für Archäologen und Historiker, Museen und Sammler, Kunsthändler und Antiquare, mit 873 Abb., xv p. + 1 400 col., which contains a large amount of facts. Their

selection is certainly capricious, yet we must be thankful to the author for his extraordinary industry and perseverance.

The *Quellenforschungen FELDHAUS zur Geschichte der Technik und Industrie*, Berlin-Friedenau are now (since June 3, 1919) organized as a limited company whose aim is the study of the history of technology and industry, the commercial exploitation of the results of these studies and the publication of the *Geschichtsblätter für Technik und Industrie* ⁽¹⁾. I extract from the first report (1920) the following information. The scientific leaders are FELDHAUS and KLINCKOW-STROEM; the capital, 125 000 marks in money plus the following assets: (1) an index of facts (ca. 80,000 cards); (2) an index of names (ca. 22,000 names); (3) an index of anniversaries (ca. 2,500 data); (4) a collection of photos and slides (ca. 10,000 photos); (5) archives containing autographs, etc.; (6) a technical library of 6,400 vol.; (7) a collection of engravings (ca. 12,000 items).

The FELDHAUS Institute carries on the following activities: Distribution of historico-technical information to collaborators, museums and colleagues for scientific purposes (gratis); investigations in connection with patents; preparation of historico-technical publications for industrial firms, to be used by them as advertizing matter or to be published apropos of an anniversary or jubilee; genealogical research relative to industrials; preparation of historico-technical articles for magazines. Finally, preparation of collections of industrial antiquities (objects, prints, etc.) for industrials! This combination of science and business is very curious. At any rate quite a number of good publications already owe their existence to the cooperative efforts of the FELDHAUS institute and of industrial firms ⁽²⁾. The idea is sound. A list of these publications may be obtained by application to the *Quellenforschungen FELDHAUS*, Berlin-Friedenau.

G. SARTON.

Iconography of Science. — I would very much like to develop an *iconographical* department in *Isis*, but have no time to take charge of it myself. Will no one volunteer to undertake this excellent piece of work? It would be useful for ex. to publish a periodical account of the medals devoted to scientists (some of the best might be reproduced each year on a plate), and of the best painted, engraved or sculptured portraits. The activity of the department might be extended to the past (that would be exceedingly useful indeed) and it might either

⁽¹⁾ *Isis*, III, 370.

⁽²⁾ For ex., *Isis*, IV, 216.

prepare the publication of a series of iconographical monographs, or simply chronicle, as they happen, the main facts and events of interest to collectors of scientific portraits, — the most precious specimens being eventually reproduced. This iconographical chronicle would interest not simply the collectors, but every historian of science who realizes the importance of the human element. Will anybody step forward?

G. S.

Reviews

Lucrèce. — *De la Nature.* Texte établi et traduit par ALFRED ERNOUT.

(Collection des Universités de France publiée sous le patronage de l'Association GUILLAUME BUDÉ) 2 vol. Paris, Les Belles Lettres 1920. [20 fr.]

Cette nouvelle publication du sublime poème de LUCRÈCE me donne l'occasion de parler de la *Collection des Universités de France* qui mérite à tous les points de vue les plus grands éloges. Les textes, tant grecs que latins, sont admirablement édités : ils sont établis avec le plus grand soin par des maîtres, révisés par d'autres ⁽¹⁾ ; les textes latins (ou grecs) et français sont imprimés en regard en caractères à la fois élégants et faciles à lire. Enfin il est possible d'acheter soit le texte seul, soit la traduction seule, soit les deux imprimés en regard.

Cette collection est publiée sous les auspices de l'Association GUILLAUME BUDÉ fondée d'ailleurs dans ce but exprès. J'éprouve une très grande joie à pouvoir exprimer dans *Isis*, l'organe du Nouvel Humanisme, mes vœux les plus sincères pour le succès de cette noble initiative. Ce succès me tient fortement à cœur, car il est clair que l'avenir de l'humanisme en France y est intimement lié. Le renouveau d'intérêt dans les classiques grecs et latins est un des résultats les plus heureux de la guerre. Il n'est pas spécial à la France : j'en ai vu des preuves évidentes en Italie et en Angleterre. Dans les pays de langue anglaise la « LOEB classical library » a beaucoup contribué à renouer les liens entre l'antiquité et le présent. Un grand nombre de volumes tant grecs que latins ont déjà paru dans la collection anglaise (chacun d'eux contenant le texte et la traduction anglaise en regard). Il est bon de remarquer toutefois que les volumes français ne sont aucunement inférieurs aux volumes anglais et qu'ils sont beaucoup moins chers (ils coûtent moins de la moitié !). De plus les membres de l'Association GUILLAUME BUDÉ (cotisation, 10 francs par an) jouissent d'une réduction de 25 p. c. sur toutes les éditions et leur cotisation est remboursable en volumes ! Au moment où j'écris, les ouvrages suivants

(1) Par ex., le Lucrèce a été révisé par GOELZER.

ont déjà paru : en latin, les Satires de PERSE et trois discours de CICÉRON ; en grec, quatre tragédies d'ESCHYLE, les Caractères de THÉOPHRASTE et cinq dialogues de PLATON.

Le texte de la présente édition de LUCRÈCE repose sur une révision et collation nouvelles des deux manuscrits fondamentaux de Leyde. Il est précédé d'une courte introduction résumant nos connaissances sur la vie et l'œuvre du poète. La traduction tout en suivant le texte latin de très près, est fluide et agréable à lire. Si tous les volumes de la collection sont aussi satisfaisants que celui-ci, le succès est certain.

GEORGE SARTON.

Steensby, H. P. [1875-1920]. — The Norsemen's route from Greenland to Wineland. 109 p., illustr., 3 maps. Copenhagen, HENRIK KOPPELS, 1918.

Reprinted with slight alterations from vol. 56 of *Meddelelser om Grönland*, Copenhagen 1917. A study of capital importance completing GUSTAV STORM's investigations. While Helluland and Markland have long been identified with the N. E. and the S. E. coasts of Labrador, no one had yet been able to localize Wineland in a fairly convincing manner. The author believes to have solved this riddle and identifies Vinland (Wineland) with a tract about St. Thomas in the estuary of the St. Lawrence or in a wider sense with the St. Lawrence valley. STEENSBY has made a deep study of the sources, that is, ADAM OF BREMEN (ca. 1075) and the sagas. He accepts STORM's theory that the saga of ERIC THE RED (ab. 1200) is of considerably greater value than the *Graenlendingaþáttir*. ERIC's saga knows of only two voyages to Wineland : the first was LEIF THE FORTUNATE's, in 1000, the other THORFIN KARLSEFN's, which most likely took place in 1003-1006. The saga deals particularly with the latter voyage. After the first publication of this memoir large subventions had been awarded to STEENSBY to enable him to complete his investigations by repeating the early norsemen voyages. Unfortunately he died suddenly on board the liner FREDERICK VIII which took him back from America to his country. He was only 45 years old (see *Isis*, IV, 43).

G. S.

Istituto di Studi Vinciani in Roma, diretto da MARIO CERMENATI. Per il IV° Centenario della Morte di LEONARDO DA VINCI, II Maggio MCMXIX. Bergamo, Istituto Italiano d'arti grafiche, xx + 442 p., molte illustr.

The Institute for the study of LEONARDO DA VINCI established in Rome has taken advantage of the fourth centenary of LEONARDO's death

to produce its first publication. It is a great pity that untoward circumstances obliged them to prepare it in such haste that the general result is rather disappointing. This hotchpotch contains, however, a few good morsels, and the most charitable attitude that the critic can take is to concentrate the reader's attention on the best pieces and help him forget the rest.

The following articles are of especial interest: ELIA MILLOSEVICH, *LEONARDO e la luce cinerea* (p. 17-19); G. B. DE TONI, *Intorno un codice sforzesco di LUCA PACIOLI nella Biblioteca di Ginevra e i disegni geometrici dell' opera « de divina proportione » attribuiti a LEONARDO* (p. 41-74); LUCA BELTRAMI, *Il volto di LEONARDO* (p. 75-95); GIUSEPPE FAVARO, *PLINIO e LEONARDO* (p. 133-138); GUGL. BILANCIONI, *LEONARDO e la fonetica biologica* (p. 159-176); MARIO CERMENATI, *LEONARDO in Valtellina* (p. 209-235); GUIDO MAZZONI, *LEONARDO scrittore* (p. 291-305); ANT. FAVARO, *La morta, la tomba, il monumento di LEONARDO* (p. 309-317); LÉON DOREZ, *LÉONARD au service de LOUIS XII et de FRANÇOIS I* (p. 359-376); ENRICO CARUSI, *Per il « Trattato della Pittura » di LEONARDO*. The last paper contains a list of references to the manuscripts for each of many chapters of LUDWIG's edition of the *Trattato*.

If the editors had had the courage to publish only the above named essays and to eliminate the many pompous and futile declarations which stuff the book, their publication would have been more creditable. But not only have they lacked this elementary courage, — but they have added some irrelevant rubbish of their own. For inst. articles on the king of Italy and President POINCARÉ, *with their portraits!* To show how uncritical this performance is, it will be enough to say that the editor has let pass without any correction Mr. POINCARÉ's reference to the Valenciennes drawings (« les fameux dessins de Valenciennes », p. 145) when every LEONARDO scholar knows that there are no such drawings in Valenciennes!

The illustration is rich but much of it has no connection with the text. There are good photographs of Vinci and Amboise. The publication is luxuriously printed, but this very luxury in a time of scarcity makes the lack of internal order and beauty more shocking.

I am looking forward to the other publications promised by the Institute (¹), hoping that they will make us forget this first one as quickly as possible.

G. S.

(¹) One of them by LIONELLO VENTURI has already appeared and is very good indeed. See *Isis*, III, 458.

Jaeger, F. M. — Historische Studien. Bijdragen tot de kennis van de geschiedenis der natuurwetenschappen in de Nederlanden gedurende de 16^e en 17^e eeuw. Met 45 figuren en portretten, 276 p. Groningen, WOLTERS, 1919. [7 fl. 50.]

A series of six historical studies previously published in Dutch reviews:

I. THEOBALD VAN HOGELANDE (b. ab. 1560 in Middelburg, Zeeland, d. 1608), a very good type of xvith century alchemist of the best kind, that is, an honest and learned man, but lacking common and critical sense. JAEGER gives us a very elaborate study of his family, and of his life and work (p. 1-50).

II. DAVID VAN GOORLE as atomist, and the VAN GOORLE family in the N. Netherlands — DAVID VAN GOORLE was born in 1591, January 15 in Utrecht, he died in 1612, April 21 in Cornjum. He is known by two posthumous works: DAVIDIS GORLAEI *Ultrajectini Exercitationes Philosophicae quibus universa fere discutitur Philosophia Theoretica, et plurima ac praecipua Peripateticorum dogmata evertuntur*, Leiden, 1620; *Idea Physicae, cui adjuncta est Epistola cuiusdam Anonymi de Terrae motu*, Utrecht, 1651. GORLACUS was an important personality, a forerunner of DESCARTES and also with the German DANIEL SENNERT (1572-1637), a forerunner of ROBERT BOYLE (p. 51-98).

III. ANSELMUS BOËTIUS DE BOODT (born in Brugge, Flanders 1550 — d. Brugge, 1632, June 21). Belgian naturalist and traveller, physician to the emperor RUDOLPH II. His main work is his *Genmarum et Lapidum Historia, quâ non solum ortus, vis et pretium, sed etiam modus quo ex illis olea, salia, tincturae, arcania et magisteria arte chymica confici possunt, ostenditur*. Hanau, 1609, which remained the standard book of mineralogy for a considerable time, and has been frequently published. A. DE BOODT was a very learned and intelligent man, who although still a peripatetician has already a modern outlook; he was a Roman Catholic and his culture was chiefly Latin (as opposed to Germanic) (p. 99-149).

IV. BEREND COENDERS VAN HELPEN, a xvith century alchemist of Groningen. This Dutch alchemist was born in Groningen, 1601, June, he died in Copenhagen, 1678, January. His was rather an insignificant personality (p. 150-170). He is not included in FERGUSON'S *Bibliotheca Chemica*.

V. WILLEM HOMBERG (born in Batavia, 1652, January 8 — d. 1715 September 24). A great chemical experimenter, to whom many discoveries are ascribed; not a great scientist. JAEGER gives us a list of his scientific papers, from 1591 to 1714, with critical notes (p. 171-197).

VI. Three hundred years of chemical teaching at the University of Groningen, followed by bibliographical lists (p. 198-254).

The author has provided many elaborate foot notes elucidating the text (*ex. gr.* giving information upon the persons quoted) and there is also a good index. His book is an important contribution to the history of Science in the Netherlands in the xvth and xvith centuries. For other publications of the same author see *Isis*, IV, 32-38, 83.

G. S.

Hellmann, G. — Aus der Blütezeit der Astrometeorologie. J. STÖFFLERS Prognose für des Jahr 1524 (*Beiträge zur Geschichte der Meteorologie*, Nr. 1, S. 5-102; *Veröffentlich. des Kgl. Preuss. Meteorologischen Instituts*, Nr. 273) Berlin, BEHREND, 1914.

The « *Almanach noua* », edited by the astronomer JUSTUS STÖFFLER of Tübingen and JAKOB PFLAUM of Ulm, Ulm 1499 ⁽¹⁾ had announced for the year 1524, an extraordinarily large amount of planetary conjunctions in Pisces and hence had predicted that extraordinary events would occur in that year. At first little attention was paid to this prognosis, but in 1517, AGOSTINO NIFO, Suessano, published in Florence a book entitled *De falsa diluvi prognosticatione quae ex conventu omnium planetarum, qui in piscibus continget, anno 1524 divulgata est*, which started a furious polemic, involving 56 authors ⁽²⁾ and causing at least 133 ⁽³⁾ writings to be printed. Never were so many books published on an astrological topic, and this is partly explained by the fact that this controversy occurred when astrology was at its height.

HELLMANN's fundamental memoir is chiefly devoted to a masterly description of these writings, preceded by a short history of astrology in general and of this special controversy in particular. Most of these writings appeared between 1517 and 1524; a few of 1524 or of a later date, were published to explain why no flood happened on the fatidical year. The memoir is followed by 34 full-page fac-similes of the most important title-pages. It is to be noted that NIFO's writing of 1517 which started the controversy, if still extant, must be exceedingly rare, for HELLMANN failed to discover a copy of it, although he applied to 52 Italian libraries: of the 2nd ed. (Naples, 1519) he knows

⁽¹⁾ Incorrectly described by HAIN (15085) and COPINGER. Described by HELLMANN in his *Neudrucke...*, Nr. 13, 1901.

⁽²⁾ Amongst whom, 20 Italian, 19 Germans and Austrians, 5 Spaniards, 4 Poles, etc.

⁽³⁾ 62 in Latin, 50 in German, 10 in Italian, etc.

only two copies, one in the National Library of Naples and the other in his own library. This is a capital contribution to the history of astrology: it increases materially our already heavy debt to its indefatigable author.

G. S.

Anthiaume, L'Abbé A. — *Cartes marines, constructions navales.*

Voyages de découverte chez les Normands, 1500-1650. Préface de l'Amiral BUCHARD, 2 vol., xiv + 566 p., 597 p, Paris, E. DUMONT, 1916.

Ces deux volumes contiennent le fruit de dix années de recherches du savant aumônier du Lycée du Havre, connu déjà par plusieurs travaux sur l'astrolabe, l'histoire de la cartographie et de la science nautiques. Voici le plan de son œuvre : Courte introduction sur la carte marine avant COLOMB. — Livre I. (1). Les origines et les caractères distinctifs de la cartographie normande; (2). Cartographes et cartes du xvi^e siècle; (3). Idem du xvii^e siècle. — Le livre II est consacré aux découvertes des Normands dans le vieux monde et le livre III à leurs découvertes dans le nouveau monde. Ces deux livres sont subdivisés géographiquement. — Le livre IV s'occupe de la science et de l'art des Normands d'après leurs cartes marines : (1). Quelques particularités des cartes normandes; (2). L'art des constructions navales en Normandie d'après la lecture des cartes complétée par d'autres documents; (3). Les divers systèmes de projection cartographique utilisés par les Normands; (4). Influence de la cartographie normande en France et à l'étranger. Vingt-et-un appendices contiennent des documents d'archives et diverses notes, particulièrement des études de nomenclature topographique. Un bref index analytique complète cette importante publication.

G. S.

Taylor, Henry Osborn. — *Thought and Expression in the XVIIth century*, 2 vol., xiv + 427 p., iv + 432 p. New York, MACMILLAN, 1920.

[§9].

A new book by the accomplished American humanist, HENRY OSBORN TAYLOR, is always a pleasant event. We owe him already an imposing series of historical syntheses; to wit, his *Ancient Ideals*, 2 vol. 1900 (2nd ed. 1913); *The classical Heritage of the Middle Ages*, 1901; *The Mediaeval Mind*, 2 vol. 1911 (2nd ed. 1914, a third ed. has recently appeared).

The purpose of his new work is « to give an intellectual survey of the xviith century, to set forth the human susceptibilities and faculties

of this alluring time, its tastes, opinions and appreciations, as they expressed themselves in scholarship and literature, in philosophy and science and in religious reform ». To give a fair appreciation, one should understand from the beginning, that the author's aim is not to offer us a really comprehensive survey; his treatment is decidedly interpretative, selective, one might add, capricious. He is at his best when he can sketch a great personality, which he happens to like: his interpretations of MACHIAVELLI, of GUICCIARDINI, of PHILIPPE DE COMMYNES are excellent; his portraits of ERASMUS, of RABELAIS, of CALVIN are superb. A scholar will object that he quotes but few authorities and not always the best, and that he is very inconsistent in the spelling of proper names, — but these are venial sins in a book of this kind, which must be judged from the literary rather than from the scholarly point of view. The subjective and selective nature of this survey is apparent at the first glance, for it is divided into 5 parts: Italy; Germany; France; England; Philosophy and science. Flanders and Spain, not to speak of other European countries, are entirely neglected. The fifth part is rather a sort of appendix. Well may Mr. TAYLOR say that the advance of science is international, and hence falls necessarily out of the frame of the four first parts. That is not entirely true, and this argument is especially specious in the mouth of one who claims that he is interested chiefly in form and expression. The substance of science is international, but its expression is influenced by national and local peculiarities almost to the same extent as other human activities. We would expect a humanist of Mr. TAYLOR's type to be primarily interested in the human side of science, and this brings us back into the national and racial frames. LEONARDO DA VINCI is as pure an Italian as MACHIAVELLI. The greatest internationalist of this period is not a scientist, but a man of letters — ERASMUS. The truth is, that the author has not integrated his knowledge of scientific advance with the rest of his historical information. However, we can but admire him for the pains he is taking to include the development of Science in his broad vision. It proves the vitality and the youth of his mind. One might also object that his survey is not sufficiently centered upon the period which he has set himself to describe. He deals at great length on the one hand with early Florentine Platonists and with NICHOLAS OF CUSA, on the other with men like HARVEY, KEPLER, BACON, GALILEO, who belong to the xvth century. One might even say that LEONARDO is more a man of the xvth than of the xvith century; he marks the climax of the early Renaissance, just as the *Divina Commedia* is the apotheosis of the xiiith century. This fifth section is divided into five chapters: the first is an introduction dealing with scholasticism, neo-Platonism and NICHOLAS OF CUSA, the second a skil-

ful portrait of LEONARDO, in the third entitled Anatomy, Physiology and Disease, he speaks among others of VESALIUS, FRACASTORO, PARACELSUS; the fourth is devoted to the « Revolution in Astronomy and Physics » (PURBACH and REGIOMONTANUS are not even quoted!); the last is a study of the « new philosophers » : TELESIO, CAMPANELLA, BRUNO and BACON.

One must be grateful to Mr. TAYLOR for having included science in his survey; by doing so, he has given an example which I hope other historians will follow. However, I cannot recommend this part of his work to the historians of science; on the contrary the reading of the four first parts will be very useful in helping them to construct the literary and philosophical background of their own historical studies.

GEORGE SARTON. .

Otto Sperling. — *Studienjahre.* Nach dem Manuskript der Kgl. Bibliothek zu Kopenhagen herausgegeben von WALTER G. BRIEGER und JOHN W. S. JOHNSON, 133 p. Kopenhagen, HENRIK KOPPELS Verlag 1920.

The manuscript which is now published *in extenso* for the first time was completed in 1673 in the « Blaataarn » (Blue Tower) of the old royal palace of Copenhagen, wherein OTTO SPERLING (born in Hamburg, 1602) was kept prisoner from 1664 to his death 17 years later. The authors have given us a diplomatic transcription of the ms. and have added ample notes, including *ex. gr.* biographical information on all the persons named in it. This is the first study devoted to SPERLING in which sufficient stress is laid on the many points of his autobiography which are of special interest to the historian of science. For this autobiography is an impressive human document which helps us to understand the life of a student of botany and other sciences in the xviii century; it contains also many personal reminiscences of the contemporary scientists. The authors have made use of SPERLING's unpublished correspondence (kept at the Copenhagen library) to elucidate or correct the text of his biography; they propose to publish eventually some fragments of this correspondence with such men as DE LE BOE SYLVIUS, JOH. RUD. GLAUBER, JEAN BRUN of BERGERAC. This carefully edited and well printed book is a valuable addition to our knowledge of scientific life and thought in the xviii century.

G. SARTON.

Blanchet, Léon [Laiz, Ain, 1884-1919]. — **CAMPANELLA** (Collection historique des grands philosophes), 596 p. Paris, ALCAN, 1920.

This book offers us a very complete study of **CAMPANELLA**, indeed the most comprehensive study of his life and works available to-day. Of course the author has taken full advantage of previous investigations, and especially of the fundamental works published by **LUIGI AMABILE** and **J. KVACALA**, but he has made a new and deep study of **CAMPANELLA**'s writings and done a great deal of original thinking. Such a survey is exceedingly important not simply because of the greatness and singularity of its object — for **CAMPANELLA**, poet, astrologer, conspirator, social and religious seer, courageous defender of **GALILEO**, is a most attaching personality — but even more because it enables us to measure more accurately what the Italian Renaissance bequeathed to **DESCARTES**, **SPINOZA** and **LEIBNIZ**. As the author says : « La pensée de **CAMPANELLA**, où se perpétuent, enrichies de conceptions neuves ou d'interprétations originales, toutes les traditions philosophiques du **xvi^e** siècle, aussi bien dans le domaine de la physique, de la psychologie et de la théorie de la connaissance, que dans celui de la magie naturelle, de la religion et de la morale, c'est le legs de la Renaissance à la pensée du **xvii^e** siècle. »

BLANCHET's book is divided in eight parts as follows : I. **CAMPANELLA's life and character**. This is of course largely based on **AMABILE**, but there are many original suggestions. The most interesting of these perhaps is the one answering the query : How could **CAMPANELLA** remain a member of the Catholic Church ? **BLANCHET** explains **CAMPANELLA**'s attitude by comparing it with that of **ALFRED LOISY** as it is candidly revealed in the latter's autobiography (see for inst. the most pathetic fragment quoted on p. 104). — II. *Physics and Psychology*. **BLANCHET** compares **CAMPANELLA**'s with scholastic ideas and also with **TELESIO**'s philosophy. — III. *His conception of science and art*. Influence of **xvth** century occultism on **CAMPANELLA** : **PARACELUS**, **AGRIPPA OF NETTESHEIM**, **G. B. DELLA PORTA**. On the other hand, influence of **GALILEO**. **CAMPANELLA**'s classification of sciences. His aesthetics. — IV. *Metaphysics*. — V. *Morals and religion*. — VI. *Sociology and positive politics*. It is in this part that **BLANCHET** describes and criticises **CAMPANELLA**'s great Utopia : the City of the Sun, — his conception of a government largely based upon scientific knowledge as he understood it (that is, a mixture of science and astrology, solid common sense and superstition. Think for inst. of his ideas on eugenics), his educational theories. — VII. *Conclusion*. The balance sheet of the Renaissance and the influence exerted by **CAMPANELLA** upon seventeenth century thought

and especially upon SPINOZA (natural religion and pantheism), upon LEIBNIZ (panpsychism), upon DESCARTES (idealism). — VIII. *Bibliography*: (1) CAMPANELLA's printed works; (2) the manuscripts; (3) his correspondence; (4) the publications devoted to him. — The absence of an index is deplorable.

The best edition of *La Città del Sole* appeared too late to be included in this bibliography. Hence it is well to say a few words of it (on the basis of MIELI's review in his *Archivio*, I, 423-424). It has been prepared by GIUSEPPE PALADINO (Napoli, GENNARO GIANNINI, 1920) and represents chiefly the primitive version of 1602. Three later versions date respectively of ab. 1611, 1623, and after 1631. — CAMPANELLA's *Apologia pro Galilaeo*, written in 1616 was published in Francfort in 1623.

BLANCHET's book is prefaced by a short biographical study written by one of his masters, LÉON BRUNSCHVIG. It is sad to think that such a promising career has been stupidly cut short by a premature death. He died from influenza at the age of thirty five. He had written a thesis entitled « Les antécédents historiques du Je pense, donc je suis » and had contributed two important papers to the *Revue de Métaphysique et de Morale*: one in 1919 on « L'attitude religieuse des Jésuites et les sources du pari de PASCAL »; the other (1920), written a month before his death, was an essay devoted to J. ROGER-CHARBONNEL's book on « La pensée italienne au xvi^e siècle et le courant libertin » (Paris, CHAMPION, 1919), a book which BLANCHET was unusually well prepared to criticize. CHARBONNEL's book is an important contribution to the history of philosophy as it helps us to understand better the transition from scholasticism to the religious thought of the xviiith century and also from Averroistic libertinage to modern freethought. It seems, however, that CHARBONNEL's knowledge of CAMPANELLA was insufficient, and it was BLANCHET's plain duty to correct and complete his investigations.

GEORGE SARTON.

Dussaud, René. — *Les civilisations préhelléniques dans le bassin de la mer Egée*; 2^e éd. revue et augmentée, x+482 p. Paris, GEUTHNER, 1914.

This second edition of DUSSAUD's work might be considered as a new work, for the amount of text and illustrations is almost doubled. The illustrations, chiefly the 14 plates of which 5 are coloured, are splendid. There are also very good maps and an excellent synoptic table showing the chronological relations between the ancient civilizations. The text is a very simple, very full and very clear account of the

results of archaeological research in the Mediterranean world (¹). Mr. DUSSAUD examines successively the archaeological evidence furnished by excavations in : (1) Crete; (2) the Cyclades; (3) Troy; (4) Greece proper; (5) Cyprus. The following (sixth) chapter deals with Aegean influence in Egypt and Syria and contains an interesting comparison between Cypriot and Phœnician art (p. 326) : « La définition de l'art phœnicien comme un compromis entre l'art égyptien et l'art assyrien est insuffisante; il faut y joindre une forte influence venue de Chypre, telle que, dans certains cas, on substituera au terme d'art phœnicien celui d'art chypriote ». — Chapter VII is a very long and elaborate study (p. 327-413), which Mr. DUSSAUD was of course especially qualified to undertake, on Cults and Myths. The last chapter is a sort of synthesis, naturally very hypothetical, of our knowledge of the Aegean peoples. It is divided into 4 main sections respectively devoted to Navigation, Writing, Language and Race.

Let us hope that Mr. DUSSAUD may be persuaded to publish a supplementary volume explaining the facts which have been brought to light since 1914. As a conscientious record of archaeological facts, scientifically described, his volume of 1914 is of lasting value, if he will only take the trouble to bring it up-to-date in a new publication. Apropos of this I would like to remark that such supplementary publications have at least one advantage upon the entirely new ones, in that they do not oblige the reader to go back over familiar ground, but give him only that which is likely to interest him most.

G. SARTON.

Budge, Sir E. A. Wallis. — *An Egyptian hieroglyphic dictionary.*

With an index of English words, king list and geographical list with indexes, list of hieroglyphic characters, Coptic and Semitic alphabets, etc., CLIV + 1356 p., 28 cm. London, JOHN MURRAY, 1920. [15 guineas].

It is unnecessary to analyze this monumental dictionary, which the adepts already have in their possession, but it is well to draw the attention of the profane to its introduction. By the way, an enormous amount of excellent stuff is buried in the introductions of many of the

(¹) It was remarkably up-to-date in 1914. Apropos of this, I must apologize for publishing this review of a capital book so late. It is not my fault. When I had to abandon my Belgian home in Oct. 1914, I took special pains to protect the books which had been sent me for review in *Isis* and had not yet been reviewed, that is, the books which did not yet belong to me. However I did not find DUSSAUD's book among the others in 1919, and would have entirely forgotten it but for a note recently discovered.

dictionaries which we use every day. If this stuff were published in ordinary book-form it would certainly be read and used to a far larger extent, — but how many stop to study the introductions of their dictionaries and encyclopedias? The introduction to BUDGE's hieroglyphic dictionary retraces the history of Egyptian lexicography — and that involves necessarily other developments of Egyptian scholarship — from 1761 on, that is, from the day that the abbé J. J. BARTHÉLEMY showed satisfactorily that the « cartouches » contained royal names. This history is a much longer story than most scholars would expect, and I will not attempt to outline it. The best that I can do is simply to give the headings of the chapters: YOUNG's hieroglyphic alphabet and vocabulary; RICHARD LEPSIUS and SAMUEL BIRCH; BIRCH's « Sketch of a hieroglyphical dictionary » (London, 1838); CHAMPOLLION's « Dictionnaire Égyptien en écriture hiéroglyphique » (Paris, 1841); BIRCH's dictionary (London, 1867); HEINRICH BRUGSCH and his « Hieroglyphisch-Demotisches Wörterbuch » (7 vol., Leipzig, 1867-1882); PIERRET's « Vocabulaire hiéroglyphique » (Paris, 1875); SIMEONE LEVI's « Vocabolario geroglifico copto-ebraico » (Torino, 1887-1894); HAGEMANS « Lexique français-hiéroglyphique » (Bruxelles 1896). The interest of this historical analysis is greatly increased by many facsimile reproductions of the older lexicons. BUDGE then proceeds to explain the inception, development, contents and methods of his own dictionary. This part of his introduction also is of great interest to the historian of science, for apropos of the fundamental problem of transliteration, he gives us a good historical account of it and shows how the transliterated alphabet changed as knowledge increased. It is now generally agreed that Egyptian is fundamentally an African language, but it has long been maintained that it was closely related to the Semitic languages; the history of this controversy is briefly told.

The present dictionary includes nearly 24,000 forms of Egyptian words collected from texts of all periods between the IIIrd dynasty and the Roman times. It is divided as follows: list of the sources; list of the most frequent hieroglyphic characters with their phonetic values together with their significations when employed as determinatives and ideographs; various Oriental alphabets; the dictionary proper in alphabetical order (1065 p.); very copious index of English words; index of Kings; indexes of geographical names (English, Coptic, Greek, Hebrew; Assyrian and Persian, Ethiopic, Syriac, Arabic); Greek, Coptic and Oriental indexes. The work ends with a catalogue of Messrs. HARRISONS' fount of Egyptian type (2863 items).

GEORGE SARTON.

Marshall, F. H. — *Discovery in Greek lands.* A sketch of the principal excavations and discoveries of the last fifty years, xii+127 p., 38 fig. Cambridge, University Press, 1920. [8 sh. 6 d.]

An excellent little book which enables one to measure quickly how much has been added to our knowledge of Greek history by the use of archaeological methods. Our literary sources are well-nigh exhausted and there is not much hope of finding supplementary information of this kind at least on the earliest times; on the contrary there is still an enormous amount of unexcavated material, and one has good reason to hope that the application of archaeological methods will still materially increase our knowledge of the distant past. In other words, the progress of positive science obliges literary men to surrender to scientists their main stronghold: ancient history. The book is divided as follows (I quote for each period the main excavated sites): I. *Earlier prehistoric period* (before 1000 B. C.): Knossos and Crete, Phylákopi, Mycenae, Tiryns, Troy, prehistoric N. Greece, Cyprus. — II. *Later prehistoric period* (ab. 1000-700 B. C.): Olympia, Sparta, Argos, Athens, Thera. — III. *Earlier historic period* (ab. 700-500 B. C.): Rhitsóna, Corinth, Ephesus, Miletus, Naukratis, Rhodes, Daphnae. — IV. *Later historic period* (ab. 500-150 B. C.): Tanagra, Tegea, Mantinea, Megalopolis, Rhodes, Pergamon, Ephesus, Priene, Magnesia, Sardes. — V. *Temple sites.* Thermos, Kabeireion, Ptoion, Oropos, Epidauros, Eleusis, Aegina, Lykosura, Kos, Samos, Assos. — VI. *Great centers of Greek Life.* Dodona, Delphi, Olympia, Delos. — VII. *Some isolated discoveries:* Corfu, disc., Giölbashi-Trysa, Sidon, Antikythera find, Mahdia find. — There is also a select bibliography, a chronological list of the main excavations (it would have been well to add the names of the main investigators and of the institutions employing them), an index, a good choice of illustrations (it is a pity, however, that no indication is given of the places where the represented objects are now exhibited). I hope that similar surveys will eventually be prepared for the other ancient civilization areas and that this one and the others will be kept up-to-date.

GEORGE SARTON.

Banerjee, Gauranga Nath. — *Hellenism in ancient India.* Second edition, thoroughly revised and enlarged, viii+344 p., Calcutta, BUTTERWORTH, 1920.

The conclusion of Book I (introductory) is that « Greece has played a part, but by no means a predominant part in the civilization of ancient India. The evolution of Philosophy, Religion and Mythology

has gone along parallel but independent paths. India owes to Greece an improvement in Coinage and Astronomy but it had begun both; and in lyric and epic Poetry, in Grammar, the Art of Writing, the Drama and Mathematics, it had no need to wait for the intervention or the initiative of Hellenism. Notably perhaps in the plastic arts and especially in the details of some of the architectural forms, classical culture has acted as a ferment to revive the native qualities of the Indian artists, without robbing them of their originality and subtlety ». — Book II deals with the Hellenistic influence on the art of India : architecture, sculpture, painting, coinage. — Book III. The evolution of scientific and literary culture in India and Hellenism : astronomy, mathematics, medicine, art of writing, literature, drama. — Book IV. Independent evolution of religion, philosophy, mythology and fables in India and Greece.

This book strikes me as being at once well-informed (though KAYE's studies are not mentioned!) and for an Indian book, remarkably well-balanced. Each chapter is followed with a long bibliography, which is not exclusively English, but without dates! It is a great pity that the book is not illustrated, for it is impossible for those not familiar with the subject to follow the argument (*ex. gr.* on the arts) without illustrations. The first edition appeared in April 1919, the second in July 1920 : a well deserved success which should encourage the author to make further efforts to improve the following editions.

G. S.

James Haughton Woods. — *The Yoga-system of Patañjali*. Grand in-8° de xli-384 p. (Harvard Oriental Series, 17). Harvard Univ. Press, Cambridge (Mass.), 1914.

Venu à l'indianisme par curiosité spéculative, M. Woods, qui compte parmi les plus éminents philosophes américains, a fait ici œuvre de spécialiste. Il s'est persuadé à juste titre que la compétence philosophique devait aider à l'intelligence des doctrines indiennes, à la condition qu'un Occidental apprit à l'école des traditions indigènes le sens authentique des textes. Ainsi est né ce livre qui résulte à la fois d'études poursuivies aux Indes mêmes, et d'une réflexion très personnelle appliquée à l'interprétation des doctrines. D'où la valeur de cet ouvrage, et son originalité en comparaison des traductions antérieures. Il nous offre à propos des Sûtras de PATAÑJALI, que l'on attribue au IV^e ou au V^e siècle de notre ère, une version anglaise du *Châsya* imputé à VYÂSA (entre 650 et 850) et de la glose de VÂCASPATIMIGRA (vers 850). La traduction est faite de main de maître; nous ne croyons pas la déprécier en lui reprochant d'être souvent, de par sa technicité, aussi

ardue à comprendre que le texte : c'est la rançon de toute version systématique; ce n'est le défaut que des œuvres excellentes. Ajoutons qu'un tel ouvrage apporte à sa façon une contribution à l'histoire de la science, car les pratiques tant intellectuelles que physiologiques, dont se compose le Yoga, n'ont jamais cessé de supposer, pour les consciences indiennes, un ensemble de faits d'une objectivité incontestée. Cette dogmatique d'une certaine ascèse et d'un certain mysticisme implique la notion très rigoureuse d'une correspondance particulière entre le macrocosme et le microcosme.

P. MASSON-OURSSEL.

J. S. Speyer. — Die indische Theosophie. In-8° de VIII-336 p. Leipzig, HAESSEL, 1914.

Recueil de conférences, ce travail est œuvre de vulgarisation, mais traitée par un spécialiste consciencieux, qui a représenté dignement, durant sa laborieuse carrière (1849-1913), l'indianisme hollandais. Le dernier tiers du volume n'offre plus la concision des deux cents premières pages; toutefois le lecteur y trouvera encore de justes aperçus et la dénonciation d'erreurs courantes. Le principal mérite de l'exposé qui remplit les deux premiers tiers de l'ouvrage est d'avoir cherché parmi les explications du système du monde et les doctrines de salut — constitutives de la théosophie au sens que S. lui prête comme M. OLTRAMARE, — les divergences d'inspiration à travers l'unité apparente des syncrétismes traditionnels. Ainsi l'on a remarqué fort à propos le caractère non védique du Yoga, la diversité des écoles dans Bhakti-mârگا, le paradoxe de l'application à l'Être suprême de la doctrine des avatâras. Toutes sortes d'arrière-pensées, de réserves (*allerlei Rückhalte und Vorbehalte*, 182) sont très finement signalées. Mais pourquoi un silence sur le vaste développement spéculatif des écoles mahâyânistes?

(Voir la notice nécrologique consacrée à JACOB SAMUEL SPEYER par J. PH. VOGEL dans le *Journal R. As. Soc.*, Jan. 1914, pp. 227-232.)

P. MASSON-OURSSEL.

Ernst Windisch. — *Geschichte der Sanskrit-Philologie und indischen Altertumskunde*, I Teil. (Grundriss d. indo-arischen Philol. u. Altertumskunde, I Bd., I Heft B.) Gr. in-8° de 208 p. Strassburg, TRUBNER, 1917. [12 Mk. 50.]

Exposé remarquablement précis et complet de l'histoire de l'indianisme jusqu'à l'œuvre de LASSEN. La contribution de chaque indologue

est définie avec objectivité, sans partialité pour ou contre aucune école ou nationalité. Le seul arbitraire est dans le choix du *terminus a quo* : pourquoi cette revue de l'*indische Altertumskunde* commence-t-elle à la fin du x^ve siècle, passant sous silence les efforts de l'antiquité comme du Moyen Age pour explorer l'Inde? VASCO DE GAMA n'a fait que suivre les exemples de MARCO POLO, de BENJAMIN DE TUDELA, de PTOLÉMÉE. En ce qui concerne l'intérêt porté par l'Allemagne aux découvertes de l'indianisme, l'ouvrage, malgré son austère *Gründlichkeit*, ne supprime pas le travail d'ARTHUR F. J. RÉMY, *The Influence of India and Persia on the Poetry of Germany* (Columbia Univers., Germanic Studies, I, No IV, 1901). Souhaitons que l'interruption de la publication à Strasbourg du *Grundriss* qui a fait voir le jour à tant d'œuvres maîtresses, ne compromette pas plus longtemps l'apparition de la seconde partie de ce monument élevé à la gloire de l'indologie.

P. MASSON-OURSSEL.

M. Winternitz. — *Geschichte der indischen Literatur*. 2 in-8° de xiii-505 et vi-288 p. Leipzig, AMELANG, 1908 et 1913.

Œuvre de mérite et de grande utilité, cette histoire de la littérature indienne sera, une fois achevée, la plus lucide, la plus complète des entreprises similaires. Des deux parties qui ont déjà vu le jour, la première, traitant de l'antiquité brahmanique, contient deux cents pages sur la littérature védique, et autant sur les épopées ainsi que les purânas; la seconde est consacrée au Bouddhisme, envisageant la littérature pâlie, canonique ou non, puis la production bouddhique de langue sanscrite. Ces deux volumes constituent dès à présent un excellent manuel, mais où le double souci d'objectivité et de clarté ont le plus souvent dissuadé l'auteur de nous offrir autre chose que des appréciations moyennes, volontiers et délibérément équidistantes des thèses plus tranchées que présentent des ouvrages plus personnels. Le maître de M. WINTERNITZ, BÜHLER, paraît avoir gardé son secret quant à la manière de concilier une extrême originalité et une impeccable objectivité. Mais sans doute est-ce le désir de bannir tout subjectivisme qui a inspiré l'élève fidèle dans la réserve et la mesure de ses jugements. Au surplus, alors même qu'il n'apporterait qu'un tableau schématique de cette immense production intellectuelle qu'a enfantée le génie de l'Inde, l'ouvrage serait précieux, tant pour les savants que pour les profanes.

P. MASSON-OURSSEL.

Abū-Mansūr 'abd-al-Kāhīr ibn-Ṭāhīr al Baghdādī (d. 1037). — *Moslem Schisms and Sects (Al-Farq Bain al-Firaq) being the history of the various philosophic systems developed in Islam.* Part I, translated from the Arabic by KATE CHAMBERS SEELYE. (Columbia University Oriental Studies, XV) viii+224 p. New York, Columbia University Press, 1920.

This translation is made from the text published in 1910 by MUḤAMMAD BADR of Cairo, a text based upon one single manuscript and not free from errors (see I. GOLDZIEHER, *Zeits. d. Deut. Morgenl. Gesell.*, Bd. 65, 1911, p. 349). It will enable students who cannot read the Arabic original to make a deeper study of Mohammedan thought. Similar writings by IBN ḤAZM and AL SHAHRASṬĀNĪ being already available it is interesting to compare these three writers, using for this comparison the material offered by MRS. SEELYE in her introduction. But before doing this it is well to recall that Moslem sects are not as spontaneous as, say, Christian sects. Indeed many of them were invented simply to justify the tradition according to which Islam would be divided into 73 sects. Hence a great number of sects separated by hairsplitting quibbles have existed either in reality or only in the brains of theologians, who do not at all agree on their classification. The Sunnites recognize no sect within the orthodox fold, but are divided into the four great schools, each of which recognizes the other : the Ḥanifite, the Mālikite, the Shafiite and the Ḥanbalite. Our three authors being Sunnites, agree thus far; their disagreements begin with the divisions of the Shiites. For the details see MRS. SEELYE's book. Let us simply introduce the three authors :

AL BAGHDĀDĪ, born in Bagdad, died in 329/1037 (see *Encycl. of Islam*, under BAGHDĀDĪ). He was versed in 17 sciences and wrote many books. The work translated by MRS. SEELYE is based upon the tradition : there shall be 73 sects in Islam, *of which one only shall be saved*. AL BAGHDĀDĪ does never lose sight of this form of the tradition, rejoicing all the time in his blessed orthodoxy. SHAHRASṬĀNĪ was born in 467 or 479 and died in 548/1153. His work entitled *Kitāb al-Mīlāl wa'l-Nihāl*, transl. by HAARBRÜCKER, Halle, 1850, is more scholarly, more carefully arranged, and he tries, not always successfully, to remain neutral. [ʿALĪ IBN-AḤMAD IBN-SAʿĪD] IBN-ḤAZM [IBN-GHĀLIB IBN-ṢĀLĪH ABŪ-MUḤAMMAD] was born in Cordova in 384/994. His book bearing the same title as that of SHAHRASṬĀNĪ, partly transl. by FRIEDLÄNDER in *Journal Am. Or. Soc.*, vol. 28-29, 1907, is unfettered by tradition and absolutely neutral. As FRIEDLÄNDER says : « We may safely assume that each name recorded in his book represents an

historical fact and not as in the case of all other writers a mere product of the imagination ». This author is especially remarkable for his « breadth of outlook, power of observation and fairness of judgment ».

To conclude, anyone who cannot afford to make a long study of all the documents should read only IBN-HAZM's book. We must be grateful, however, to Mrs. SEELYE for having made accessible to us another source less valuable in itself yet worth considering. It is not possible to understand Moslem science if one does not know their religious thought; Mrs. SEELYE has given us one more key to their soul. We hope that the end of her translation will not be delayed too long.

GEORGE SARTON.

Goldziher, Ignaz. — *Le Dogme et la Loi de l'Islam*. Histoire du développement dogmatique et juridique de la religion musulmane. Traduction de FÉLIX ARIN, viii-318 p. Paris, PAUL GEUTHNER, 1920.

This translation of GOLDZIHNER'S *Vorlesungen über den Islam* appears ten years after its German original and six after it was itself finished. Yet that does not mean that GOLDZIHNER'S work is in the least out of date and still less that it has been superseded by any later work. It is exactly as authoritative as it has been from the beginning and holds the same unique position among the books on Islam of the whole learned world. Those of us who are students of Islam know very well that GOLDZIHNER is the father of us all; and while we may disagree with him on details, we have always an uneasy consciousness that he may be right after all. The title of the French translation — an admirable translation, often reading more easily, even for those who are familiar with German, than does GOLDZIHNER'S somewhat involved style — limits the book more narrowly down to theology and law than does the original *Lectures on Islam*. According to the chapter-headings the book covers (I) MOHAMMED and Islam; (II) the legal development; (III) the theological development; (IV) asceticism and mysticism; (V) the sects; (VI) later formations. To each is added an array of notes and references, intended for the student who has access to the original sources and covering in this translation 50 pages of small type. A hardly adequate index of fifteen pages, reproduced without additions from the German, closes the book. But the subject-matter is wider than these rubrics suggest. It is the whole essence and being — genus, species and differentia — of Islam, taking that term as correlative to Christendom. It is true that GOLDZIHNER carefully avoids treating philosophy, but to the present reviewer that is

the weak point of his method. It is impossible to make the attitude of AL-GHAZZALI, for example, thoroughly intelligible without dealing with those of AVICENNA and AVERROES, as AQUINAS involves ABELARD and DUNS SCOTUS. And excluding philosophy excludes with it physical science, which would come under philosophy in a Moslem system of encyclopedia. All other activities, physical and mental, in the Moslem civilization fall under crafts, trades, occupations; a physician, for example, would be either a philosopher or a barber-surgeon; an architect would be a masterbuilder; any kind of artist would be a craftsman. This, of course, reminds us at once of medieval Europe and it may be said shortly that there was no break in medieval times between Islam and Christendom, each understood the other in a way that has never been possible since the renaissance.

But for the readers of this periodical the interest of GOLDZIEHER'S book must lie in the light which it throws on the position of science, in the modern sense, in Islam. Of that there is no explicit treatment, but it is made very plain by the whole drift of development that science has never been, in any true sense, a permanent, self-continuing element in that civilization. Only exceptional individuals have been interested in science, and schools of science have flourished only under the protection of princely patrons. The flowering times of Baghdad, Cairo and Cordova were short and left no heirs. This is the real explanation of the puzzle of the impermanence of Moslem civilization. The university life of Islam turned steadily to theology and canon law and to their strictly ancillary disciplines. And these latter dwindled, through lack of independent life and interest, until philosophy became scholastic theology and astronomy became the art of constructing the ecclesiastical calendar. For fuller consideration of this primary historical fact I venture to refer to my paper of sixteen years ago, read before the St.-Louis International Congress and printed in its Proceedings. Of course, there were from time to time individuals interested in all the facts of the world. But they were few. AL-BERUNI stands almost alone in objective consideration of the non-Moslem world. The professed « philosophers » — of various phases of the neo-Platonic Aristotelian amalgam — either enjoyed princely protection or camouflaged themselves, sincerely or insincerely, with mysticism, or else externally « conformed », confiding their real views to their own students. It is significant how early it was that Islam developed the idea of an economy of teaching, that truth must be different for different classes of minds, which led to the twofold truth of the European Averroists. In Islam truth was admittedly manifold, and some orthodox theologians were driven — between philosophy and dogmatics — to a doctrine practically that of the different classes

of « judgments » of our own day. But all these were isolated cases and it was only in the mystical schools that free speculation continued in any measure to flourish, with tendencies even there toward crystallizing into barren scholasticism.

The end could not be doubtful. Theology was not only the queen of the sciences; it came to reign alone and, so doing, became sterile. Such sciences as, through the ineradicable vitality of the human mind, survived, took forms which could relate themselves to theology — magic, astrology, alchemy. They could thus justify their existence by an assertion of usefulness. For the intellectual life of Islam had passed under the ban of utilitarianism. However excellently science in the abstract might be praised, the sciences were always divided into the praiseworthy and the blameworthy, and the blameworthy were those which could not give a useful reason for their existence; useful, that is, for man's life in this world or for his future salvation. Anything else man had better leave alone, even if there were nothing especially hurtful in it. A universally accepted and much quoted tradition from the Prophet is adduced in support of this position. « It is part of the beauty of the Islam of a man that he should leave alone that which does not concern him. » Under this ruling the pure sciences cannot be cultivated and only the applied sciences are possible, a position amply sufficient in itself to explain the decadence of Islam. And it must not be thought that this was the position of theologians and ethicists only. IBN KHALDUN, the Berber, who died A. D. 1406, while not technically a man of science like AL-BERUNI, has left us, in his *Prolegomena to History*, a most open-eyed and intelligent picture of the whole Moslem civilization of his time, applying to it a very acute psychological and historical analysis. His book is unique in Arabic and he was evidently deeply interested, in the modern sense, in all the phenomena of life. But this apparently unconscious attitude and practice of his were contrary to his explicit teaching, for, in at least two places in his book (DE SLANE's *transl.*, III, p. 185 f., 285 f., QUATREMÈRE's text, III, p. 135 f., 258 f.), he lays down the position stated above and quotes in support of it the tradition.

Nothing of this will strictly be found in GOLDZIEH's book; but its reader will easily see there within what narrow bounds the normal intellectual life of Islam was permitted to move, and will understand HEINRICH RITTER's dictum that the ingenious but fantastic atomic scheme of the Moslem scholastic theologians is Islam's most characteristic and original contribution to the history of philosophy and not the derivative comments and supercomments of the Arabic-writing Aristotelians and neo-Platonists.

DUNCAN B. MACDONALD.

Julius Ruska. — Zur ältesten arabischen Algebra und Rechenkunst. in *Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Philosophisch-historische Klasse*, p. 1-125, 1917.

This work by **RUSKA** and the work of **SUTER** on the astronomical tables ⁽¹⁾ of **AL-KHOWARIZMI** are certainly the most noteworthy contributions to the history of medieval Arabic science, made within the past decade. Both occupy themselves with the achievements of the great Arabic mathematician, astronomer, and geographer, **MOHAMMED IBN MUSA AL-KHOWARIZMI**, whose contributions to elementary arithmetic, algebra, and trigonometry are fundamental in the development of these subjects, directly influencing nomenclature and methods for seven centuries and exerting influence even to the present day. **AL-KHOWARIZMI**'s contributions to astronomy and geography were equally important in the development of these subjects among the Arabs.

The discussion of the Arabic terminology and the Latin and English translations of **AL-KHOWARIZMI**'s *Algebra* by **RUSKA** throws new light upon the whole subject from the point of view of modern Arabic philology, the first adequate treatment of this subject. At the same time **RUSKA** discusses various questions touching the development of mathematical ideas in a scholarly manner. While here and there one may disagree with the conclusions drawn by **RUSKA** one cannot deny that the historical and philological facts involved are clearly presented by one who is a master of Arabic and of philological method as applied to historical problems.

The twelve sub-divisions of **RUSKA**'s work have the following titles :

- I. The title of **MOHAMMED BEN MUSA**'s algebra.
- II. The Liber augmenti et diminutiones and the Kitab alġam'wal-tafrik.
- III. The Regula Sermonis.
- IV. Content of M. b. M. 's algebra and treatment of its sources from **COSSALI** to **CANTOR**.
- V. On the history of the Arabic numeration (names of numbers).
- VI. On the Inheritance problems in M. b. M. 's algebra and the original application of the terms, *mal* and *schai*.

(1) Die astronomischen Tafeln des **MUHAMMED IBN MUSA AL-KHOWARIZMI** in der Bearbeitung des **Maslama ibn Aġmed al-Maġriti** und der latein. Uebersetzung des **Athelard von Bath** auf Grund der Vorarbeiten von **A. Björnho** und **R. Besthorn** in Kopenhagen, herausgegeben und kommentiert von **H. Suter**, Zurich. *Mémoires de l'Académie Royale des Sciences et des Lettres de Danemark*, Copenhagen, 7^{me} Serie, Section des Lettres, vol. III, 1914.

- VII. The terminology of the quadratic equations.
- VIII. On the development of the number system.
- IX. The names of the Arabic numerals.
- X. The chapter on mercantile problems.
- XI. Concerning the chapter on measurement.
- XII. M. b. M. 's Algebra as a part of his total scholarly achievement.

So far as the title (*ḥisab alġabr walmuḳābalah*) is concerned, RUSKA shows that ROSEN is extremely careless and unscientific in his English translation of the two terms involving the idea of restoration or completion (*alġabr*) and of reduction or comparison (*almuḳābalah*). Both terms are carefully explained by AL-KHOWARIZMI in connection with algebraic problems. When the Arab arrives at the equation

$$10x - x^2 = 21$$

he conceives of $10x$ as being incomplete by the amount x^2 which he « completes » with x^2 , arriving at $10x = 21 + x^2$; the word used for « completes » is a verb formed from the same stem as *ġabr* (*alġabr*). When the Arab arrives at an equation $50 + x^2 = 29 + 10x$, he « reduces » by casting out 29 from the 50, arriving at $21 + x^2 = 10x$; the verb used for « reduces » here is from the same stem as *muḳābalah*.

The precise and literal translations of selected passages of AL-KHOWARIZMI's algebra and of other Arabic works constitute a noteworthy part of RUSKA's contribution to our knowledge of Arabic mathematical science. The discussion of the medieval Latin translation published by LIBRI, probably due to GERARD of CREMONA, shows that this translation was carefully made by one who had a keen perception of the niceties of the Arabic language; this directly controverts the statements which have frequently been made from the time of ROGER BACON down maligning the whole group of translators of the eleventh and twelfth centuries. ROSEN's translation is shown repeatedly to be inferior in interpretation of Arabic terminology to the Latin translation. In fact RUSKA shows that the Latin translation of the LIBRI text was based upon a better Arabic text than the one used by ROSEN. So far as the terms for x and x^2 are concerned, ROBERT OF CHESTER uses « radix » and « substantia » throughout the preliminary discussion, but in the problems changes to « res » and « substantia ». The fact that the second power of the unknown was considered almost as a second unknown is well illustrated by the text of ABU KAMIL who solves geometrically, as I have shown (*The algebra of ABU KAMIL, Bibl. Math.*, v. 12, p. 40-55, 1912), not only for « radix » but also for « census »; in this he was followed by AL-KARKHI. Any consistent symbolism was not found until the time of VIETA.

RUSKA calls attention properly to the importance of the neglected

portions of AL-KHOWARIZMI's work, those dealing with the inheritance problems and with mensuration problems. On the Hindu source of many of the algebraical, arithmetical and geometrical ideas involved in this work, RUSKA throws new light, while at the same time he points out the particular contributions of the Arabs as a race, and of the author AL-KHOWARIZMI as an individual. In particular the definite Hindu character of the chapter on mercantile transactions is clearly demonstrated on the basis of material in ARYABHATTA, BRAHMAGUPTA and BHASKARA; similarly with the work on mensuration, including the approximate formulas for the length of circular arcs, and areas of the segments.

To one point of view taken by RUSKA (p. 48) serious exception can be made. To assert that the practical uses of computations in daily affairs was the occasion of the extension and development of either arithmetic or algebra is as unwarranted a deduction as the assertion, repeated since the time of HERODOTUS, that geometry owes its origin to the measurement of land. The necessity for these developments is intellectual. The demands of the commercial life of Greece had no part in the progress of Greek science, nor were the scientific developments of the Arabs dependent upon commercial needs. It must be admitted, of course, that the Hindus and the Arabs, like the Egyptians, had a keener sense than the Greeks for application of science to affairs, but this was primarily by way of popularization rather than as source of development.

In passing should be mentioned RUSKA's article: « Neue Bausteine zur Geschichte der arabischen Geographie⁽¹⁾ » in which is emphasized the importance of AL-KHOWARIZMI's contribution to early map-making. AL-KHOWARIZMI's « surat alard » was the text accompanying a world map, much improved by Arabic geographers over PTOLEMY's map. The manuscript of this geographical work appears to be in Strassburg, having been found in Cairo in 1878 by W. SPITTA⁽²⁾. Later NALLINO⁽³⁾ and more recently HANS V. MZIK⁽⁴⁾ have given further information

(1) *Geographische Zeitschrift*, Vol. 24, 1918, p. 77-81; RUSKA here inadvertently speaks of the author as ABŪ GA'FAR M. B. M., instead of ABŪ ABDALLAH M. B. M.

(2) W. SPITTA, *HUWARIZMI'S Auszug aus der Geographie des Ptolemaeus*, *Zeitschrift Deutschen Morgenl. Gesell.*, vol. 33, 1879.

(3) NALLINO, AL-HUWARIZMI e il suo rifacimento della Geografia di Tolomeo, *Atti della R. Accad. dei Lincei*, Anno 291, Serie V, *Memorie, Classe di Sc. Mor.*, Vol. II, Rome, 1896.

(4) HANS V. MZIK, PTOLEMAEUS und die Karten der arabischen Geographen, *Mitteil. d. k. k. Geogr. Ges. in Wien*, Vol. 58, 1915, p. 152; Afrika nach der arabischen Bearbeitung der γεωγραφικὴ ὑφήγησις des CL. PTOLEMAEUS von MUH. IBN MŪSA AL-HUWARIZMI, *Denkschriften d. Akad. d. Wissen. in Wien, Phil.-hist. Kl.*, Vol. 59, 1916.

concerning the work, and V. MZIK has reconstructed the map of Africa.

RUSKA has thrown light upon a series of difficult problems in connection with Arabic science. The Arabic contributions to Western civilization touch vitally many different fields. Their direct and indirect contributions to navigation and discovery in the fifteenth and preceding centuries has never received adequate appreciation. A work like this by RUSKA deeply concerns the whole intellectual history of medieval Europe, as modern historians of this period are beginning to realize.

(University of Michigan.)

LOUIS C. KARPINSKI.

T. Endō, *History of Japanese mathematics*, revised and enlarged (in Japanese). With notes by MIKAMI, OKAMOTO and ŌTANI and with a biography of the author by MIKAMI, 702 p. Tokyo, 1918.

Mr. Endō was a zealous student of the history of Japanese mathematics. He began his studies in this direction in 1878 and published the results of his research in 1896 in a work entitled *History of Japanese Mathematics*. He devoted his time to revising and enlarging this work from then on, until 1915, when he died at the age of 72. Under the direction of the late Baron KIKUCHI his manuscripts were set in order by Y. MIKAMI, N. OKAMOTO and R. ŌTANI, whose notes are recorded in the margin of the book. The resulting work is twice as large as the original publication.

Mr. Endō divides the history of Japanese mathematics into four periods :

The first period : Primitive Japanese age, about which almost nothing is known.

The second period : beginning with the viiith century A. D., when Chinese arithmetic was introduced and learned in Japan. There are few records concerning this age. In later times the Japanese forgot their previous knowledge.

The third period : which includes the beginning of the Edo Era, or the xviiith century, during which Chinese works were learned for the second time. The Japanese were soon to advance in their own mode of learning.

The fourth period : beginning with the appearance, about 1675 of SEKI KŌWA. His achievements are highly Japanese in character, most of them not appearing in previous Chinese works. His disciples, both direct and indirect, advanced still further. The establishment of the *endan* and *tenzan* algebra and of the circle-principle is most noteworthy of this period.

The fifth period beginning with AJIMA's revision of the circle-principle, and ending with the organization of the *Sûgaku Kaisha* — Mathematical Society — in 1877. The Restoration of 1868 forms a distinct break in the history of Japanese mathematics, after which scholars take up European mathematics principally, and postpone the older native science. For a while, however, the latter struggled desperately for existence. The newly founded association was composed of members of both parties, between whom there sometimes arose bitter enmity. The older science rapidly lost ground. Mr. ENDÔ does not describe these matters, although he has himself been present at the very scene of the struggle. Nor does he give any account of the native mathematics which followed. Characteristic of this fifth period is the treatment of various problems leading to double or multiple integration. Various other interesting problems, mostly of a geometrical nature, were also handled and solved.

Mr. ENDÔ gives his account in chronological order. He is very remarkable for the richness of his materials, in the compilation of which he was exceedingly painstaking. It is to be regretted, however, that he has, as a rule, failed to record his sources of reference. He is sometimes not discriminating in his judgments. The weakest point of the work lies in the author's utter ignorance of Chinese mathematics.

Mr. ENDÔ writes as follows :

The publication of YOSHIDA's treatise of 1627 was of great value for the progress of Japanese mathematics. Some time later, the abacus algebra of the Chinese became known in Japan. Though the authorities did not support the pursuit of this science, individuals among the people were eager for its advancement. SEKI now appeared on the scene. He established the written algebra of true Japanese form, which developed from the Chinese abacus algebra. He and his disciples made various discoveries. There arose several rival schools. Since crafty men would sometimes learn of the achievements of others and publish them as their own, it became necessary to keep discoveries secret. In SEKI's school the highest diploma was given only to two persons, an act which has certainly proved detrimental to the natural growth of the science. It was customary, in the enemy schools, moreover, to disregard the art of mensuration. The FUJITA-AIDA controversy uselessly exhausted the effort of students. Because the stream of progress was now flowing in vigorous torrents, however, the discussion retarded it to no great extent. Various mathematicians vied with one another, and their happy emulation resulted in many discoveries.

In the latter half of the xviii century, the problems of inscribed figures were mainly studied. Since there were soon no new problems

of this kind, the mathematicians strove to excel each other in their skilful treatment of old problems. Successive improvements upon the rules of solution given by previous writers ensued. As, however, there was no knowledge of geometry in Japan, the scholars found difficulty in selecting new, interesting problems. The barrenness in physical sciences was also highly detrimental to the progress of Japanese mathematics. But in the domain of the circle-principle, after the improvements of AJIMA and WADA, science was wonderfully developed in a way quite incomparable to that of former times. The solution of complicated problems became a simple matter. This progress has resulted entirely from the efforts of private individuals.

As to the contents of the work, it cannot easily be told in brief, because the subjects are arranged in chronological order and are very numerous.

(Tokyo)

YOSHIO MIKAMI

Science in Japan (in Japanese). By the Japan Civilization Society. XXI+415 p. Tokyo. 1917.

Histories of special sciences in Japan have occasionally been written, as, for example, FUJIKAWA's History of Japanese Medicine, ENDŌ's History of Japanese Mathematics, etc.; but the treatise before us is the sole one that considers the entire subject of Japanese science, as a whole, in a single volume. We regret only that the name of its author is withheld. Though the work treats of the development of science in Japan from oldest times, it is professed that the Meiji Era, or the latest growth, is mainly considered. For this purpose the book is divided into three parts :

1. Oriental sciences studied and completed in Japan (p. 1-116);
2. Introduction and spreading of European learning (p. 117-215);
3. Science in the Meiji Era (p. 217-415).

This scheme shows that the work is quite different from those of FUJIKAWA and ENDŌ, who considered mostly or wholly the old Japanese science. In some parts it undoubtedly follows the plan of Marquis OKUMA's History of the Fifteen Years of the Opening of the Country.

In the opening chapter the nature of Japanese civilization is discussed. Though some consider it to be wholly imitative, the author does not admit it. He maintains that it is assimilative. Japan was not content with base imitation of Chinese and Hindoo civilizations, nor did she remain on a lower level than these. Confucianism and Buddhism as developed in Japan prove this clearly. Japan's assimilation of Occidental civilization during the last half-century has been brought about in a manner similar to those of former times when she came in contact

with the civilization of China and of India. Thus does Japan devour and digest the civilizations of other peoples.

Medicine early developed in Japan, being influenced first by Indian and then by Chinese art. Some treatises on medicine were early written, marking the progress of medicine in advance of other branches of knowledge. In modern times medical men have sometimes been in advance of philosophers in matters of thought. It is thus shown that medicine has always held a most important place in the progress of Japanese learning. Natural history is an outgrowth of medicine. In describing the progress of medical science the author appears in the main to be following Dr. FUJIKAWA's great work.

Mathematics is considered in regard to the causes of its progress. These are presented as follows :

1. Arithmetic being generally known to the people;
2. Establishment of the astronomical board by the Shogunate;
3. Establishment of astronomical boards and of mathematical schools by local feudal authorities;
4. Love for learning and willing instruction;
5. A succession of proposals of problems and their solutions;
6. Suspension of arithmetical tablets before the temples.

I have myself discussed the same problem in the *Shigaku Zasshi*. The author in the main accounts for ENDO's opinion. He considers the existence of rival schools and the ensuing controversies as lamentable events in the history of science; but this may be considered otherwise, since these very events have, in a certain sense, undoubtedly been for the good of scientific progress.

In Japan astronomy flourished only as the art of calendrical regulations, of which this work gives only a short sketch, without going into a discussion of its development. The progress of mathematics among the people fortunately brought about the calendar reform, after a long interval of retrogression. Physics and chemistry were practically unknown in Japan until after the influence of Europe.

The progress of industry is briefly considered, but nothing is said of its relation to the development of science.

The introduction of Western learning began when the Portuguese brought in the gun. The Christian missionaries, who soon after visited Japan, sometimes practiced medicine. It was thus that the Portuguese knowledge of medicine prevailed over the older art. The Dutch in subsequent years brought with them the art of war and the science of medicine, two branches of learning which were most conspicuous among the Dutch sciences learned by the Japanese. Its superiority in the knowledge of anatomy has largely contributed to the adoption of Dutch learning in Japan, since the older knowledge of the

Japanese on the subject had been of a very meagre kind. It was in 1771 that the first Dutch anatomical treatise was translated in Japan. SIEBOLDT's visit to Japan proved of advantage in spreading Dutch science. It reacted upon older Japanese science in such a way as to invigorate the spirit of the advocates of the latter. There ensued therefore a rivalry between the two parties. In the end, however, the Shogunate founded a school where Dutch medicine was taught. The medical men of the Dutch school were quick to learn, in addition to their special subjects, politics, gunnery, military science, fortress construction, etc., etc., becoming in consequence, the leaders in the propagation of this newly come civilization. The influence of these studies has in no small degree brought about the opening of the country for foreign intercourse. The need of building ships and organizing new armies was so keenly felt by the feudal lords of ministerial rank that men were sent to Holland to learn modern methods. Medical students were also sent there. The necessity of competing with foreign powers was the cause of this general advance, which resulted in the political change of government called the « Restoration ».

After the Restoration of 1868 the importation of Occidental knowledge was conducted on a larger scale and with determined hand. In the earlier periods of seclusion, the old classics had been most revered; now the positive sciences were brought to the fore. A splendid scheme of school education was planned, and was satisfactorily carried out.

The two decades following the Restoration were spent in adopting the foreign sciences, special education being conducted mainly by foreign professors. Thereafter the Japanese were able to assimilate what they had learned from abroad. Gradually native scholars began to appear, replacing by degrees their foreign masters. During the course of this development, the art of medicine was in the lead, and consequently medical institutes were made foremost in the university system of Japan. All the various branches of sciences, however, were taught and learned to some extent.

It must be noted that scientific education was not at first brought into intimate contact with practical life. In the latter domain capitalists and courtisans were used to carry out their functions under the guidance of foreign engineers. This state of affairs has long held the public from paying reverence to science and to scientists. The progress of education, however, did gradually send forth educated engineers into society, and scientists of some merit gradually advanced in their achievements. The outbreak of the great war was of great benefit to the progress of science in Japan, since the public was compelled by circumstances to recognize the usefulness of science.

Y. MIKAMI

Y. Mikami. — The causes of the development of mathematics in Japan, *The Shigaku Zasshi*, vol. 29, n° 3.

The flourishing age of old Japanese mathematics covers the entire period of the Tokugawa Shogunate. Its development is due first to the introduction of Chinese mathematics, Chu'eng's work of 1593 and Chu's work of 1299 being mainly studied. Practical need also induced its development, for the time had come when a knowledge of mathematics was required in land survey, large fortifications, irrigation work, etc., etc. The improvement of social conditions was a further influence. Economic development, greater leisure, ineffectualness of religious restrictions, increasing self-consciousness, all these proved of importance for the development of mathematics as well as for the general progress of civilization.

The Japanese remoulded the mathematical knowledge which they received from China, for, as will appear in the case of art and architecture, Buddhism, philosophy, etc., remoulding was the usual outcome of Japanese civilization.

The best example of mathematical remoulding will be seen in the development of written algebra from the abacus algebra of the Chinese. In this, the Dutch influence is insignificant. The Japanese notation of algebra was the natural outgrowth of the method of recording algebraical representations by calculating rods which was used by the Chinese. The use of these rods had directly influenced the development of Chinese mathematics, and continued to work indirectly upon the progress of Japanese mathematics.

The *soroban* also had great influence. Although calculating rods could be used for higher numerical equations, yet their actual application was so cumbersome that the Japanese always preferred the *soroban*, which proves very convenient in practice, and endeavored to devise some treatment of problems by which this dexterous abacus could be used in solving them. As a result certain methods of infinite expansions and repeated approximations were established.

Japanese mathematics contains much that is of no practical value. Most of their problems were non-practical in nature. The Japanese studied mathematics principally for the sake of enjoyment. Tablets presenting mathematical problems together with their solutions were often suspended before the temples — a practice which shows that mathematics was considered as a form of art. Although the art of mensuration was held in very low esteem by the Samurai class, yet even some members of the feudal lords' class and of other ranks had a taste for mathematics. They studied it despite the mockery of their friends, as if it were a form of pastime. In most cases they could earn

nothing from their knowledge of mathematics, since there was little opportunity to gain a livelihood as a professional mathematician. Exceptions were extremely rare.

The problems considered in Japan are very numerous, but they may be classified under a small number of headings. Most of them differ from those that accompanied the first rise of Japanese mathematics. The methods of solving them also differ. Japanese mathematics was not rich in principles and methods, but in the practical exercise of the few which they possessed the Japanese were very skilful. The same fact holds true in the case of the fine arts and of the art of war.

In Japanese mathematics, methods of demonstration were not fully developed. The Japanese often preferred incomplete induction, or inference from numerical values. Geometry as a demonstrative system had no place in Japan. Japanese mathematics is full of erroneous results.

Complicated problems were at first prevalent, but after a time simplifications set in. The passing of time has brought a gradual theoretization of mathematics. European influence is quite undeniable, and appears in the use of trigonometry, logarithms, problems on the centre of gravity, etc., yet the whole structure of Japanese mathematics was never shattered during the entire period of foreign influence. The case is quite different from those of astronomy and calendrical art, into which the European system was introduced.

Y. MIKAMI.

Y. Mikami. — *Magic squares in Japanese mathematics* (in Japanese), iv + 174 p. Tokyo, Imperial Academy of Science, 1917.

The Japanese mathematicians were fond of artistic considerations of non-practical problems. One kind was that of magic squares, concerning which there are numerous documents. This subject was, of course, introduced from China, the works of YANG HUI and CHU SHIH-CHIEH, who flourished in the XIIIth century, being the earliest treatises that contain examples of magic squares. These works were brought to Japan. YANG's work, indeed, in which magic squares are considered, was lost in China. YANG's and CHU's magic squares are similar.

There are several printed works in Japan of the XVIIth century, in which examples of magic squares are given. ISOMURA (1660), MURAMATSU (1663), SATŌ (1666) and HOSHINO (1672) are the authors of these works. In a written work of 1683, SEKI treated the subject of constructing one form of magic squares. ANDŌ treats another way of

constructing magic squares in a printed work bearing the dates 1694 and 1695. ANDŌ says that he has learned his method of consideration from SHIMADA, in 1653, a date which is the oldest in Japan that bears upon the matter. The contemporary of SEKI and ANDŌ, TANAKA, discussed in a manuscript treatise the construction of magic squares, according to which consideration many different arrangements may be obtained. His work bears the date of 1683.

SEKI's disciples, TAKEBE, MATSUNAGA and AOYAMA wrote several manuscripts, in which they considered new methods of constructing magic squares. KURUSHIMA's way is very interesting. Heretofore, during SEKI's time, layer after layer of a magic square were successively arranged; now a different mode of procedure was adopted.

When the methods of construction had advanced to this point, there arose an attempt to enumerate the different magic squares which may be constructed. YAMAJI was perhaps the first mathematician to enter this field. He tried to give the number of all 5-squares which may be arranged according to SEKI's method. A few anonymous manuscripts refer to similar treatments. After YAMAJI's time there appeared several mathematicians to carry out the same scheme.

Toward the close of the old Japanese school of mathematics, new attempts of constructing methods were made by ICHIKAWA, GOKAI and others.

These subjects are treated under thirty-four separate heads. Prof. T. HAYASHI published a comment on the work in the *Tokyo Butsuri Gakko Zasshi*, No. 312, 1917. He adds something very interesting about TANAKA's work of 1683, based upon a better manuscript of it.

Y. MIKAMI.

S. Kanetsune. *Music in Japan* (in Japanese). Tokyo, 1912. —
H. Tanabe. *Lectures on Japanese music* (in Japanese). Tokyo, 1919.

Because these two works contain many facts of interest to students of the history of science, something of their contents is here given.

The music of the Japanese, though first introduced from China, was ultimately destined to be remoulded to suit their own taste. The musics of the two nations are fundamentally different from each other, being reflections of their respective national characters. The Chinese had held music in high esteem from remotest times, as will be seen from the use of the term *li-yüeh*, — 'institutions and music'. There is no wonder, therefore, that the Chinese have made extraordinary

progress in music. They early considered the theories of music, some accounts of which are found scattered in the older classical works. But the *Shih-chi* (Historical Records) and the *Huai-nan Tsū* are the oldest works remaining extant in which a full treatment of the subject appears, both belonging to the first century B. C. In these works the musical scale is considered to be formed by a method called the increase and decrease of one-third of the length of a given musical tube. Thus twelve tubes are obtained which give a scale of twelve tones, in essence corresponding to PYTHAGORAS' scale. CHING FANG of the later HAN Dynasty applied the same method of treatment and found a scale of 60 tones, said to be essentially the same as BOSANQUET'S scale of 53 tones. Subsequently CH'EN YÜEH-CHIH of the LIU-SUNG Dynasty obtained a scale of 300 tones, and CH'EN CHUNG of the L'IAN Dynasty, a scale of 360 tones. Thus the same way of treatment was followed for many hundreds of years, but at last, toward the close of the MING Dynasty, CHU TSAI-yü abandoned the method of taking one-third, and adopted one of taking a geometrical average, whereby he obtained a new system of twelve tones, which is equivalent to the twelve average intervals of the West. MR. KANETSUNE discusses these matters at considerable length in his work, the separate topics of the subject having previously been treated in several articles in the *Tōyō Gakugei Zasshi* by MR. TANABE and Prof. S. NAKAMURA.

There are two kinds of music, Mr. KANETSUNE says, the one being born music and the other constructed music. Chinese music belongs to the latter class, of which none is found in other Asiatic nations (p. 425). Thus in China the rules of harmony were obtained as results of scientific treatment, upon the actual applications of which there ensued the gigantic harmonical music of the SUI and T'ANG Dynasties (TANABE, p. 27). The musical instruments which were imported from China to Japan in those times are known to have been of highly developed kinds, some of them being provided with several tubes with tongues and small holes at and near their bottom, some with resonance boxes, some with chords whose lengths could be controlled at will by the finger. In the method of harmony with regard to the instrument called *shō*, the resolution of dissonant sounds was already adopted. Thus all the formal elements had been in existence and standing upon a firm scientific basis, and the mode of composition, also in wonderful progress, was already comparable to the subsequent development in Europe during the seventeenth and later centuries. The Chinese alone were able in those early ages to succeed in such a logical way with musical composition. Nevertheless Chinese music was preëminent only in its formal respect; as to its contents,

Indian music must be preferred. It is only since the YUEN Dynasty that the Chinese have begun to attach some importance to the contents of music, and that dramatic progress has been made. (TANABE, p. 96-129).

Since the Chinese are essentially a people given to reason, formal music of this kind has developed among them. But the Japanese are of an emotional disposition, so that the magnificent harmonical music imported from China has only undergone a kind of retrogression, being at last replaced by an emotional kind of music characteristic of the Japanese. In China even Confucianism was left much to the consideration of scholars in its formal or rationalistic aspect. In Japan, where theoretical treatments were little in favor, the practical application of the doctrines was better realized. (TANABE, p. 22-23).

TANABE divides the development of music in Japan into four stages, as follows :

The first or primitive period : There was no instrumental music; only some crude kinds of vocal music prevailed.

The second or Chinese period : when the formal music of China was introduced and cultivated. In the first half of the period, which lasts to the first half of the tenth century, only the court nobles struggled to imitate the Chinese mode of instrumentation. In the second half of the period, which comes toward the end of the court supremacy, or the twelfth century, the instruments brought in from China underwent some remoulding, and there arose a kind of vocal music in which harmony was inclined to be neglected. By and by the literal meaning of songs came to be stressed.

The third, or feudal period : Japan was now free from foreign influence, so that music was destined to make progress in a true Japanese way, and there appeared nothing but vocal music, which served only to express the senses of songs. This period is divided into three sub-periods :

A) *The Kamakura era.* (xiith-xivth centuries). — Now disappeared altogether the formal music of the preceding age. The local feudal warriors who had just come into power were so little educated that they needed a very primitive kind of music. But this era is important in the history of Japanese music as being an age of transition, during which music was being transformed into something dramatic and sensual.

B) *The Muromachi era* (xivth-xvth centuries). — Now, the Shogunate being opened in Kyoto, the feudal vassals were influenced by the formalistic, cultured atmosphere of the old imperial capital. Thus the music of this era becomes enveloped in a sort of formalism, although

its essence still lies in its dramatic contents. This may be a piece of contradiction. But the warriors' life was a contradiction in itself in those days, for they had to meet and congratulate even lamentable death with a smile. The so-called Bushidō, or warriors' morals, were merely emotional, and never explicable by dint of reason. The warriors were accustomed to support their emotions on the one hand and to suppress them on the other. In thus leading a contradicting life, they necessarily developed a form of music expressing this contradictory mood.

The Japanese, since they were not of a rationalistic turn of mind, were not able to appreciate a purely rational harmony. Melody, likewise, was not retained in the music of these simple-minded warriors. Time was the only element which was kept. Because music was to consist of this single element alone, the *yōkyoku* appeared, a form of music in which the organization of the time-element is wonderfully complicated and developed.

C) *The Edo era* (xvth-xixth centuries). — Japanese music now becomes very variegated, the different classes of people having come into possession of typical sorts of music. But the most characteristic forms of this era were those that arose among the merchants and laborers, the aim of which was the expression of human sentiment, and the mode of execution of which was wonderfully developed. But these pieces of music are of little value without the Japanese words, and are utterly destitute of scientific basis. TANABE considers especially the *jōruri* as the most representative among them. Its development separates naturally into two stages, first at Ōsaka and then at Edo.

Ōsaka was a city that had long flourished and was open to trade, its merchants being wealthy and leisureful, and the surrounding territory having been long influenced by the old culture of the imperial capital. The merchant of Ōsaka was thus destined to introduce a new kind of music which embodies common-sense, is free and unconstrained by any theoretical considerations, and which expresses the internal conflicts of obligation and sentiment. The common-sense education of the Ōsaka merchants did not suffice, however, for the further development of the music thus brought into existence.

Now Edo becomes the centre of Japanese culture. Music too continues its development there. At first coarse kinds of music flourished, but there was soon transplanted to the Shogun's capital a sort of music which had originated in Kyoto. Because this ancient capital was now out of worldly activities, its music, too, was not of a lively character and lacked force of expression. The conventional colour of old times was, however, retained in some way, which gave it an esti-

mable character. This piece, when played at Edo, must discard all its conservative garments of Kyoto, and assume a new colour suitable to the newly-established feudal capital. The artisans were now gaining the ascendancy in the community of Edo. They were without education, and could not, therefore, understand the sense of sentiment, as had been the case in Ōsaka. They were generally poor and worked by the day, and so were keen in sentiment and inclined to strong impulses. In their music they cared little for form or style; they needed only that which pleases the ear or which satisfies the senses. The statements of songs thus became out of tune.

In the emotional music of Japan, the Chinese mode of harmonic scales was postponed, the scales being accounted for unaided by the eye. In consequence, there arose the so-called melodic scales. In the vulgar music of the Edo era the scales were freely arranged and regulated according to the moods which sentiment produced. As a result, the scales cannot be measured mathematically as in the case of Chinese music. In Japan no occasion arose for theories of music to make their appearance.

A kind of scale, of twelve tones, had, to be sure, unwittingly arisen in Japan, but it was of a kind utterly unknown in China, so that all efforts to explain it from the standpoint of Chinese musical theories failed. The mathematician NAKANE GENKEI was the only person in Japan who could give a rule for the Japanese scale of music. All this shows clearly that the Japanese, though skilled in the art of execution, had no ability whatsoever, as a theoretician; a fact in direct contrast with Chinese genius.

The fourth or modern period: the present age, during which Occidental music was introduced and continues to be studied. Nothing characteristic of the Japanese is as yet to be ascertained in connection with this lively and prosperous epoch.

The forms of music characteristic of the Japanese have all been vocal. One exception may be pointed out in the case of the *jiuta*, played with the accompanying instrumentation of the *koto*. This subject is treated in full by KANETSUNE. According to him, the *jiuta* consists of a series of fine phrases, the meaning of whose words is second in importance to the accompanying instrument. KANETSUNE, in discussing the source of this kind of music, accounts, first, for its place of origin having been the ancient city of Kyoto; second, for the use of the *koto*, which is suitable for independent instrumentation; and third, for the interest taken in this form of music by blind men, who prefer the sounds of songs to the senses of them. (KANETSUNE: p. 153-156).

(Tokyo.)

YOSHIO MIKAMI.

Graesse, J. G. Th. — *Kunstgewerbliche Altertümer und Kuriositäten.*

Führer für Sammler und Liebhaber von Gegenständen der Kleinkunst, von Antiquitäten sowie von Kuriositäten. Begründet von J. G. Th. GRAESSE, fortgeführt von F. JAENNICKE. 6te Aufl., samt Zeittafel und Register bearbeitet von FRANZ M. FELDHAUS, 262 S. Berlin, R. C. SCHMIDT, 1920.

The first ed. of this book appeared without any text in 1871 under the title *Guide de l'Amateur*; a second so-called « édition revue et augmentée », differing little from the first one, followed in 1877. The 3rd ed. entrusted to F. JEANNICKE appeared in 1904 under its German title; this was really a new book; the 4th ed. dated 1909 was very similar to the 3rd one. The fifth (1916) and the present ed. were prepared by FELDHAUS, who has made use of THIEME and BECKER's *Künstlerlexikon* and of his own extensive material partly published in *Die Technik*, 1914. — This Guide is divided into 25 chapters each devoted to one of the arts or to a special kind of objects; *ex. gr.* Elfenbeinplastik; Glyptik; Eisenschnitt; Niello; Tula; Email; Glasmalerei; Uhren; Wandteppiche; Waffen; Brillen; etc. Each chapter contains a short historical summary, with more or less miscellaneous information, bibliographical notes and a chronological list of craftsmen. The chief feature, perhaps, is a large collection of craftsmen-marks and signatures (p. 221-258) — This book contains a large amount of information in very condensed form, and will prove useful to the collector and the antiquarian. Yet, there is still room in it for considerable improvement.

G. S.

Thomson J. Arthur. — *The System of Animate Nature.* The GIFFORD lectures delivered in the University of St.-Andrews in the years 1915 and 1916. 2 vol., xx + 687 p. London, WILLIAMS and NORGATE, 1920.

« It has been declared by some that the world is a dismal cockpit, that in the behaviour of living creatures mind is a negligible quantity, that the study of heredity must leave us fatalistic and that evolution is largely a chapter of accidents. Such views engender what may be called natural irreligion and it is the object of this course to show that such views are scientifically untenable ». Part I. The realm of organisms as it is : (1) the unfathomed universe and the aim of science; (2) organic *vs.* inorganic nature; (3) criteria of livingness; (4) organism and mechanism; (5) uniqueness of life; (6) animal

behaviour; (7) the problem of body and mind; (8) the fact of beauty; (9) the issues of life; (10) adaptiveness and purposiveness. — Part II. The evolution of the field of organisms; (11) the concept of evolution; (12) great steps in organic evolution; (13) originative factors in evolution : variation; (14) directive factors in evolution : selection; (15) the individual and the race : heredity; (16) the evolution of mind and mind in evolution; (17) nature crowned in man; (18) disharmonies and other shadows; (19) the control of life : lessons of evolution; (20) *vis medicatrix naturae*. This very stimulating book, based on a sound knowledge of the relevant facts, is less a philosophy of biology than a general philosophy from the point of view of the biologist. Complete summaries of each chapter enable one familiar with the subject to follow and appreciate quickly the author's argumentation.

G. S.

Jaeger, F. M. — *Elementen en Atomen eens en thans*. Schetsen uit de ontwikkelingsgeschiedenis der elementenleer en atomistiek. 2de verbeterde druk, met 24 fig., 50 portr. en 1 kaartje, VIII + 312 blz. Groningen, Wolters, 1920,

F. M. JAEGER is professor at the University of Groningen, Netherlands and the author of a very remarkable book on the Principle of Symmetry (see *Isis*, IV, 32). The present book has been prepared as a textbook for Dutch students. Rather than to attempt to give in a little more than 300 p. a complete history of chemistry, JAEGER has wisely chosen to concentrate his attention upon the development of our notions on elements and atoms. Thus limited, the history is much simpler, and much more effective. The plan is as follows : (1) notions of elements in antiquity and in Asia; (2) elements and atoms as conceived by the Greeks before ARISTOTLE; (3) ARISTOTLE; (4) origin, form and propagation of alchemy; (5) iatrochemical and phlogistic periods; (6) atomism in the nineteenth century; (7) modern ideas; unity of matter; (8) index. The last chapter on contemporary science is very full (p. 210-281), and will enable the reader to have a very complete view of the development of chemistry, almost to our own days. The author has taken great pains to go back to the sources whenever possible. The footnotes contain much bibliographical information, and there are many well chosen illustrations. For other historical studies by the same author, (see *Isis* IV, 50).

G. S.

M. Delacre. — *Histoire de la Chimie*, xvi + 632 p. (140 × 225), Paris, GAUTHIER-VILLARS & C^{ie}, 1920.

[Sans indication de prix.]

Cet ouvrage est « un livre de combat », nous dit l'auteur dans sa préface. Comme tel, et malgré sa documentation, il ne peut prétendre être une histoire de la chimie. Et en fait, il constitue surtout une charge à fond contre les hypothèses, les idées théoriques que l'auteur était tenu d'enseigner dans sa chaire de l'Université de Gand, et pour lesquelles cet enseignement lui a donné, dit-il, « une irrémédiable aversion ».

Niera-t-on cependant, pour ne prendre qu'un exemple, que la relation réciproque des notions d'oxydation et de réduction ait été pour la première fois éclaircie par la théorie du phlogistique, que des expérimentateurs aussi habiles que PRIESTLEY et SCHEELE ont acceptée pendant toute leur vie?

Certes, la science n'est pas l'étude des hypothèses, elle doit être l'étude de la réalité, des sensations, mais, comme l'a fortement marqué JEAN PERRIN, « à condition d'adjoindre aux sensations actuelles toutes les sensations possibles ».

M. DELACRE est trop foncièrement « chimiste » pour être historien. Il considère la chimie comme une entité, pourrait-on dire, et nulle part ne s'inquiète du mouvement des idées dans les autres sciences, ni dans la philosophie. Il eût cependant été particulièrement important de le faire pour ceux qu'il appelle avec mépris les Professeurs de 1860.

Nous avons ici une histoire des faits bruts, appuyée sur des textes, mais non l'histoire de leur genèse.

Et même, avons-nous vraiment l'histoire des faits bruts? L'attitude combative de l'auteur permet d'affirmer le contraire. La phrase suivante, par laquelle sont jugées les synthèses de carbures d'hydrogène, de BERTHELOT, est assez représentative : « Que valent *pour l'époque* ces synthèses de carbures? Ce sont trop souvent des réactions brutales, à rendements infimes, et qui ont perdu *aujourd'hui* tout intérêt. » (non souligné dans le texte, p. 569.)

Enfin, cette citation de la dernière phrase du dernier chapitre en dit long sur un certain état d'esprit dont n'a pas pu se défaire l'auteur. « Mais il nous paraît certain qu'on jugera que tous les FISCHER du monde ne viennent pas, tous ensemble, à la cheville d'un PASTEUR ou d'un DEVILLE. » C'est là du nationalisme, et non de l'histoire de la chimie.

L. GUINET.

Baddeley, John F. — Russia, Mongolia, China, being some record of the relations between them from the beginning of the xvth century to the death of the Tsar ALEXEI MIKHAILOVICH (A.D. 1602-1676). Rendered mainly in the form of Narratives dictated or written by the Envoys sent by the Russian Tsars, or their Voevodas in Siberia to the Kalmuk and Mongol Khans and Princes; and to the Emperors of China. With introductions, historical and geographical also a series of maps showing the progress of geographical knowledge in regard to Northern Asia during the xvth, xvth and early xvth centuries, the texts taken more especially from manuscripts in the Moscow Foreign Office Archives, 2 vol. in folio, 16 + CCCLXVI p., 22 maps and 3 plates printed separately, illustr. in text and genealogical tables; xii + 448 p., 3 pl. and 5 maps printed separately and other illustr. London, MACMILLAN, 1919. [Only 250 copies at 12 guineas each.]

This important publication offers us the results of research carried on by Mr. JOHN F. BADDELEY during eight years and it embodies the experience of many more. It developed in an unusual way. The second volume was written and printed first; it was in type before the war; the index to both volumes appears at the end of vol. I. This is simply due to the fact that after having edited the texts which fill the second volume, the editor realized the necessity of adding historical and geographical introductions. These introductions grew as his enquiries advanced and they make up the greatest part of vol. I. Historians of science will take special interest in the geographical introduction of which I will speak presently.

Volume the second contains the English translation of a series of narratives written or dictated by Russian envoys in Mongolia and China. Most of these narratives have not been published before except in Russian; some have not even been published in Russian and of these the Russian text is given in vol. I (except in the case of the TUKHACHEVSKY'S Mission, 1634-1635, the Russian text of which was mislaid by the editor). The earliest text published, relating to an expedition to and beyond the Yenesei in 1602-1609, no longer exists in Russian and is known only through a Dutch translation by ISAAC MASSA published by HESSEL GERRITZON, Amsterdam, 1612, together with other information, in a small volume entitled : *Beschrijvinghe vander Samoyeden Landt in Tartarien* (1)... Many other

(1) Speaking of this book, Mr. BADDELEY says (vol. II, p. 1) "that no other ever presented in so small a space so much new, varied and important geographical information."

seventeenth century texts are published in full — too many to be quoted here, all the necessary elucidations being given in the foot-notes or in appendixes. These texts will help to explain the history of Russian expansion in the East, and also the development of our geographical and ethnographic knowledge of Northern Asia.

In the historical introduction (96 p.) an endeavour is made to explain the development of N. Asia from the earliest times down to the beginning of the seventeenth century. This history is divided into three parts: Before the Mongol Invasion; The Invasion; After the Invasion. Special chapters are devoted to: Mongols and Kalmuks; VASILI II to YERMAK, with notices of HERBERSTEIN, MENDEZ PINTO and JENKINSON; YERMAK (d. 1585); Lamaism; The State of Affairs in N. Asia c. A. D. 1600. Two interesting notes complete this historical survey. One is a brief history of the Settlement of Siberia (1586 to 1718), the other deals with sables. Let me quote a few lines of SPATHARY; they attest in a picturesque way to the immense importance which these furs had taken in ancient times « Now the Sable is a beast full marvellous and prolific, and it is found nowhere else in the world but in Northern Siberia... a merry little beast it is, and a beautiful: and its beauty comes to it with the snow, just as with the snow it disappears. And this is the beast that the ancient Greeks and the Romans called the Golden Fleece ».

For us the most interesting part of the book is the Geographical Introduction (119 p.) which retraces the whole development of our knowledge of N. Asia, special emphasis being laid on the maps. The most important of the ancient maps are minutely described and analyzed, critically compared and splendidly reproduced. One cannot praise Mr. EMERY WALKER too much for these excellent reproductions. It is worth while to quote the maps examined by the author.

A first chapter takes us rapidly from the earliest times to the GODUNOFF map. These earliest maps are not reproduced, but the information which they offer on N. Asia is briefly analysed. After a few short paragraphs devoted to antiquity, the Dark Ages, the Orient and the early relations between South Russia and Siberia (relations clearly proved by the analogies between Siberian and Scythian art), Mr. BADDELEY considers successively the following maps:

EDRISI, 1154; MARINO SANUTO, 1320; DULCERT (? DALORTO) 1339; PIZZIGANI, 1367; Catalan Map, 1375; Borgian Map, ca. 1410; LEARDUS, 1442, 1448; FRA MAURO, 1459; BEHAIM, 1492; WALDSEEMÜLLER, 1516; AGNESE, ? 1525; WIED, 1542; HERBERSTEIN, 1546; JENKINSON, 1562; MERCATOR, 1538, 1569; ISAAC MASSA, 1612; GERRITZHOON 1613; SANSON, 1650, 1654. The total result of this analysis (vol. I, p. cxi), is

« that practically the whole of the information added to European maps of Middle and Northern Asia from PTOLEMY to the second half of the seventeenth century, came from EDRISI, MARCO POLO, WIED. HERBERSTEIN, JENKINSON and MASSA... This information, such as it was, left all Asia north of the old silk-traders' route and east of the Ob, speaking broadly, as unknown as the reverse of the moon. So that it remained for the Russians in their clumsy, ignorant, rule-of thumb way, and one zealous Dutchman, NICOLAAS WITSEN, to throw light for the first time on those vast regions... »

The author now proceeds to examine very carefully the following maps :

- 1525 BATTISTA AGNESE. Map of Russia. Reproduced.
- 1562 JENKINSON.
- 1570 ABRAHAM ORTELIUS, Tartariae sive Magni Chami regni typus (*in Theatrum Orbis Terrarum*). Reproduced.
- 1657 JAN JANSSEN. Tartaria sive Magni Chami Imperium (*in Atlas Novus...*, Amsterdam). Reproduced.
- 1667 The GODUNOFF Map. The original being lost, it is only known through different copies. A copy made by the Swedish envoy to Russia, FRITZ CRONMAN (or KRONEMAN) in 1669, is reproduced; a Russian version of 1672 (?) and another Swedish version of 1674 are also reproduced and discussed.
- 1673 Ethnographical Map of Northern Asia (REMEZOFF Atlas, sheet no. 23/25). Reproduced.
- 1690-1693 SCHLEISSING's Map. Another version of the GODUNOFF map of little value. Reproduced.
- 1692 Le R. P. AVRIL. Nouvelle carte de la Sibérie et du Kitay ... tirée de l'original de la chancellerie de Moscou. Reproduced and discussed in vol. II, p. 215 sq.
- 1687 NICOLAES CORNELISZON WITSEN (1641-1717). This map is discussed and compared with that of STRAHLENBERG (1730) and with modern maps (see synthetic sketch map). « On the whole, WITSEN's map, with all its shortcomings, marks the most important addition ever made at one time to the cartographical knowledge of Northern Asia. »
- 1696-1701 The REMEZOFF maps. (The original atlas, manuscript, is in the RUMIANTSEFF Museum, Moscow. It was reproduced *imperfectly* in 1882, by the Imp. Archaeological Commission. The ethnographical map of 1573 quoted above, is a part of that atlas). Three more REMEZOFF maps are here reproduced : Map of all the waterless and difficult country of the mountain steppe; The EKATERINHOFF-palace Wall Map of N. Asia; Map of the Yakutsk Town-Territories.

Bef. 1733 The RENAT maps (two reproduced in fac-simile, with key maps).

1836 Sungaria, excerpt from KLAPROTH map.

1862 Sungaria, excerpt from the Kien-Lung Jesuit map.

1760 Sungaria, excerpt from the Kien-Lung Jesuit map.

1724 Sungaria, UNKOVSKY's map (with key map).

Among the appendixes to vol. I, I should mention a bibliography of the subject (MSS. and printed books, Russian and Non-Russian) and genealogical tables of Mongol and Kalmuk princes. Among the notes of vol. II, the two most interesting perhaps are one devoted to the traveller and adventurer NIKOLAI GAVRILOVICH SPATHARY (1625 or 1635-1708) — the records of his travels and residences in N. Asia fill more space (vol. II, p. 204-422) than all the other records here published; — and another devoted to the great personality of Father FERDINAND VERBIEST, S. J. By the way, Mr. BADDELEY seems to be unacquainted with the biographies of him given in 1912 and 1913 by H. BOSMANS, and in 1913 by A. DAMRY, also by L. VAN HEE ⁽¹⁾. Other studies may have appeared apropos of the inauguration of VERBIEST's statue in his native place Pitthem, W. Flanders in 1913 ⁽²⁾. On the other hand, I draw the attention of VERBIEST's biographers to the new information on his life derived from Russian sources, which is contained in Mr. BADDELEY's book.

It is to be deprecated that only 250 copies of this important book have been published. Such a small edition would not even be sufficient to enable each large library of the world to obtain a copy. Much as I love beautiful books, I have no sympathy for that collector's aberration which prompts them to publish limited editions to increase artificially the number of rarities. It is as if they could only enjoy a thing to the extent that others were deprived of it. Their selfishness debases the love of letters and beauty into greed and speculation. Most of the books published in small editions by collectors are so unimportant that their scarcity does not matter, but when a work as fundamental as Mr. BADDELEY's is dealt with in the same way, there is good reason to be anxious and sad ⁽³⁾.

GEORGE SARTON.

⁽¹⁾ See *Isis*, I, 159, 551, 765; II, 268; iv, 146.

⁽²⁾ See *Isis*, I, 705. The German invaders reaching that little village in 1914, must have been not a little surprised to be suddenly confronted with a Chinese mandarin!

⁽³⁾ Mr. JOHN F. BADDELEY published previously: *The Russian Conquest of the Caucasus*, xxxviii + 518 p., London, LONGMANS, GREEN & Co., 1908, and another book of his has just appeared: *Russia in the Eighties, Sport and politics*, xvi + 467 p. London, LONGMANS, 1921.

Vom Altertum zur Gegenwart. *Die Kulturzusammenhänge in den Hauptepochen und auf den Hauptgebieten.* Skizzen von F. BOLL, A. CURTIUS, u. s. w. VIII + 308 p. Leipzig, TEUBNER, 1919.

The preface dated May 1919 and signed by EDUARD NORDEN, professor of classical philology in Berlin, explains that the aim of this book is to provide the German people at a critical juncture with a careful estimate of their intellectual patrimony. The only way to endure the present misfortune is to look toward a new era and to be ready to work hard to reconstruct a new and better world. But in order to do that, it is more than ever necessary to take stock of all that the past has bequeathed to us. To do our share of the work with courage and faith it is enough to realize the continuity and the unity of civilization. Whatever happens, this unity, this integrity must be preserved. This is certainly a noble thought and it is much to the credit of the German scholars that they prepared the writing of such a book at the darkest hour in the history of their country. This return to the past to strengthen one's ideal, is essentially a return to Greece, and this book is chiefly a study of Hellenism, of its relations with the modern world and its special signification under the new circumstances. It is placed under the patronage of PLATO, GOETHE and HUMBOLDT.

The work is divided into two main parts, — one devoted to the unity of civilization in general at various periods of our history, — the other, considerably longer, to unity and continuity in special domains of human endeavour. This second part contains seventeen chapters, dealing with practically every aspect of modern culture. The first nine deal with law, politics, education, philology, history, literature, art, religion, philosophy. The others are devoted to special branches of science, and as these are of greater interest to the readers of *Isis*, I will quote the names of their authors: mathematics by CONRAD MÜLLER, cosmology and physics by ERNST GOLDBECK, astronomy by FRANZ BOLL, geography by JOSEPH PARTSCH, biology by H. STADLER, chemistry by E. v. LIPPMANN, medicine by JOHANNES ILBERG, technology by ALBERT REHM.

It would be interesting to compare this undertaking with a similar one in England, due to the initiative of FRANCIS SYDNEY MARVIN (see *Isis*, II 425, III 419). Briefly, the German effort is much more comprehensive and systematic; it is more exclusively concerned with one part of the past, Hellenism; it is also more nationalistic. On the other hand, it must be noted that MARVIN's endeavour is far more effective because it is repeated year after year, and takes the form of live lectures to a large and responsive audience before being crystallized in print and buried in book form.

G. S.

Eugenio Rignano. — *Psychologie du Raisonnement*, xii + 544 p. in-8°
Paris, ALCAN, 1920. [15 fr.]

EUGENIO RIGNANO, le directeur de *Scientia*, à qui nous devons déjà plusieurs œuvres vraiment fortes et originales ⁽¹⁾ vient de nous donner un nouveau livre tout à fait admirable. La thèse fondamentale de l'auteur c'est que « le raisonnement est constitué tout entier par le jeu réciproque des deux activités fondamentales de notre psyché : les activités intellectives et les activités affectives, les premières consistant dans la simple évocation mnémonique de perceptions ou d'images du passé, les secondes se manifestant comme des tendances de notre esprit vers une fin donnée à atteindre, vers laquelle est dirigé le raisonnement lui-même ». Il est à remarquer que les tendances affectives ont elles-mêmes une origine et une nature mnémoniques (le premier chapitre est consacré à la démonstration de cette thèse). Il suffit alors d'admettre cette spécificité unique — *la propriété mnémonique* — pour expliquer toutes les manifestations finalistes de la vie. C'est en effet grâce à cette propriété spécifique que les organismes vivants peuvent reproduire des modalités énergétiques d'adaptation *exclusivement par des causes internes*, ou en d'autres termes, c'est grâce à cette propriété que les êtres vivants sont mûs en partie par des forces *a fronte* et non pas seulement par des forces *a tergo*. On pourrait diviser l'univers en deux groupes nettement tranchés : le monde inorganique régi exclusivement par des lois physico-chimiques ; le monde organique, régi par les mêmes lois, mais caractérisé en plus par la propriété mnémonique qui fait qu'aux forces externes s'ajoutent des forces internes. Le monde organique lui-même peut être divisé en deux nouveaux groupes, moins nettement tranchés toutefois : les êtres doués de la propriété mnémonique, et ceux chez qui à cette propriété s'ajoutent des activités affectives qui rendent possible l'élaboration du raisonnement, la manifestation la plus haute et la plus complexe de l'aspect finaliste de la vie. « De là vient, nous dit l'auteur (p. 535), la tragique et éternelle opposition entre notre vie intérieure, toute imprégnée de finalisme, qui sent que ce finalisme est la chair de sa chair et le sang de son sang, et le monde extérieur inanimé, qui, si anxieusement qu'on l'ait scruté durant des siècles et des siècles, ne nous semble mû, au contraire, par

(1) *Un socialisme en harmonie avec la doctrine économique libérale*, éd. ital., Turin, 1901 ; éd. franç., Paris, 1904. *La sociologie dans le cours de philosophie positive* d'AUGUSTE COMTE, éd. franç., Paris, 1902 ; éd. ital., Palerme, 1904. *Sur la transmissibilité des caractères acquis*. (Hypothèse d'une centro-épigénèse), éd. franç., Paris, 1906 ; éd. ital., Bologne, 1907 ; éd. allem., Leipzig, 1907 ; éd. anglaise, Londres, Chicago, 1911. *Essais de synthèse scientifique*, éd. franç., Paris, 1912 ; éd. angl., Londres, 1918.

aucune finalité. Et cette tragique et éternelle opposition entre le microcosme essentiellement finaliste et le macrocosme purement mécanique c'est elle qui constitue le substratum profond de la lutte plus que millénaire entre la science et la religion, la première contrainte par la raison fondée sur les faits à dénier à l'univers une finalité, la seconde, par contre, irrésistiblement poussée à l'affirmer par les plus intimes fibres du sentiment ».

La thèse de RIGNANO est appuyée sur une documentation à la fois très riche et très prudente et il la démontre avec beaucoup de rigueur et de méthode. Il suffira ici d'indiquer brièvement les grandes lignes de son exposé. Il s'efforce tout d'abord dans les trois premiers chapitres de retrouver par la méthode phylogénétique, l'origine et la nature intime des phénomènes psychiques fondamentaux : les tendances affectives et l'attention. Dans le chapitre IV, il examine la question *Qu'est-ce que le raisonnement?* et généralisant la notion du « Gedankenexperiment » de MACH, il montre que le raisonnement n'est autre chose en substance, qu'une combinaison mentale d'expériences imaginées. Il s'attache ensuite à montrer qu'une telle expérimentation mentale est bien loin d'être stérile. La fécondité du raisonnement est due d'une part à la fécondité même de l'imagination, d'autre part à l'intensité affective orientée vers le résultat à atteindre. « C'est cette affectivité, visant à une fin donnée ou recherchant le sort d'un objet donné, qui constitue, en somme, le phénomène psychique, qui, seul et unique, reste invariant durant tout le cours du raisonnement. C'est par suite elle qui associe, lie, enchaîne les unes aux autres, les diverses péripéties expérimentales, auxquelles on suppose soumis l'objet de notre désir; et c'est par suite elle qui constitue ce qu'on appelle le fil du raisonnement. » (p. 128). Les chapitres V et VI sont consacrés à l'étude de *l'évolution du raisonnement* : (1) du raisonnement concret au raisonnement abstrait; (2) de l'intuition à la déduction, et les chap. VII à IX, à l'étude *des formes supérieures du raisonnement* : (1) le raisonnement mathématique dans ses phases du symbolisme direct et indirect; (2) le raisonnement mathématique dans ses phases de condensation et d'inversion symbolique; (3) mathématiques et logique mathématique. Ces trois chapitres intéresseront tout spécialement les historiens des mathématiques; je n'essaie point de les analyser. RIGNANO montre ensuite qu'indépendamment de ce raisonnement constructeur, dont il vient d'étudier les manifestations les plus hautes, il en existe une forme dérivée et corrompue qui vise plutôt à classer et à présenter des faits connus, d'une certaine façon plutôt que d'une autre. C'est ce qu'il appelle le raisonnement « intentionnel ». Il en distingue deux formes fondamentales, à l'examen desquelles les chapitres X et XI sont dévoués : le raisonnement dialectique et le raisonnement métaphy-

sique. Ces deux chapitres renferment d'excellents morceaux de critique, par ex. sa démonstration de l'inanité de la spéculation métaphysique, et sa critique des idées vitalistes. Dans le chapitre XII, RIGNANO étudie les *diverses mentalités logiques* : esprits synthétiques et analytiques; esprits intuitifs et logiques; esprits romantiques et classiques; esprits audacieux et esprits timides; imagination et érudition, originalité et mémoire; visuels et auditifs; raisonneurs constructifs et raisonneurs intentionnels; positivistes et métaphysiciens. La conclusion de cette revue c'est que les facultés logiques d'un individu sont influencées dans une très large mesure par sa nature affective. Pour compléter sa documentation, RIGNANO fait maintenant appel à la *pathologie du raisonnement* qui est admirablement traitée dans les trois chapitres suivants (XIII à XV) : (1) l'incohérence et l'illogicité des rêves. La théorie de l'auteur c'est que la propriété fondamentale des rêves c'est d'être *non-affectifs*. Cette théorie me paraît très satisfaisante; elle explique fort bien les phénomènes oniriques. Il est intéressant de remarquer que cette théorie est diamétralement opposée à celle de FREUD; (2) fous cohérents et illogiques par mono-affectivisme. L'étude des paranoïques et des monomanes est particulièrement intéressante parce qu'elle permet de distinguer et de séparer nettement deux caractéristiques fondamentales du raisonnement, la cohérence et la logique; (3) fous incohérents par instabilité, impuissance ou absence des tendances affectives. La conclusion de ces études pathologiques, c'est que l'équilibre mental n'est qu'équilibre affectif et que la cohérence et la logique de notre pensée sont essentiellement d'origine affective. Un dernier chapitre étudie le *raisonnement conscient et inconscient*. Après avoir établi que « chaque état psychique n'est pas lui-même ni conscient, ni inconscient, mais devient l'un ou l'autre seulement par rapport à quelque autre état psychique servant de point de repère » (p. 507), (cela est en partie une question de définition) (1) il s'efforce de prouver que la plupart des psychologues ont attaché une importance excessive à l'inconscient et qu'au contraire « le raisonnement, chez l'homme normal, se produit presque exclusivement à l'état conscient et que la part de l'inconscient dans l'idéation géniale est presque nulle ou tout à fait nulle » (p. 529). Quoique l'argumentation de RIGNANO soit assez convaincante, je ne puis accepter cette

(1) Ce chapitre nous donne aussi (p. 486) une excellente définition de la *compréhension* : « comprendre, c'est pour ainsi dire, rapporter au substratum affectif de l'individu tel ou tel groupe d'éléments sensoriels ou mnémonico-sensoriels; c'est donner une tonalité affective à ce que projettent en nous, du monde extérieur, nos sensations et nos souvenirs respectifs ».

dernière conclusion sans réserves. Il est certain que la part de l'inconscient a été exagérée, mais au risque d'être traité de « mystique » par l'auteur, il me semble que son propre radicalisme rend bien difficile l'explication du génie précoce, celui de MOZART ou de GALOIS par exemple.

Je me suis étendu assez longuement sur l'œuvre de RIGNANO, parce qu'elle est d'une importance capitale pour tous ceux qui s'intéressent à la philosophie et à l'histoire des sciences. Les historiens notamment y trouveront un bon nombre de matériaux sur la psychologie de l'invention. Il serait utile de comparer cet ouvrage au *Traité de Logique* de GOBLOT (cfr. *Isis*, III, 306). Ces deux livres sont indépendants et extrêmement différents, bien que les auteurs aient au moins un but commun, c'est-à-dire d'expliquer la fécondité du raisonnement. Mais GOBLOT est surtout un dialecticien et un philosophe, tandis que RIGNANO est plutôt un savant, un biologiste.

Il me paraît extrêmement désirable que la *Psychologie du Raisonnement* soit traduite aussi vite que possible en anglais.

G. SARTON.

Pierre Boutroux. — *L'Idéal scientifique des mathématiciens*, 274 p., Paris, ALCAN, 1920. [8 fr.]

M. BOUTROUX s'est proposé de dégager les tendances des mathématiques modernes de manière à pouvoir faciliter l'orientation des jeunes mathématiciens. Il s'est aperçu bien vite que cela lui serait d'autant plus facile que le passé des mathématiques lui apparaîtrait plus clairement. De là, sa curiosité historique, curiosité limitée d'ailleurs par son but pratique précis. « C'est dans l'histoire des sciences, convenablement étudiée, que nous avons le plus de chances de découvrir les fondements et la direction de la pensée scientifique. — L'histoire des sciences ainsi entendue est à égale distance de l'observation psychologique individuelle et de la systématisation philosophique. Elle est donc la préface naturelle de la philosophie des sciences » (1). — Il examine donc successivement avec beaucoup de clarté et d'élégance la conception hellénique des mathématiques, puis ce qu'il appelle la conception synthétiste. L'attitude du géomètre grec était surtout contemplative; il s'efforçait de dévoiler la beauté, l'harmonie de l'uni-

(1) P. 8 — Que le lecteur me pardonne de rappeler que c'est là un point de vue que je défends depuis dix ans. J'ai fondé *Isis* (inspiré par COMTE) pour construire collectivement les fondements historiques de la philosophie des sciences. Voir par ex., t. I., p. 193-196.

vers et obtenait ainsi une science harmonieuse mais étroitement et arbitrairement limitée. — La conception qui s'élabore ensuite lentement grâce aux efforts des algébristes orientaux et chrétiens et qui triomphe vers la fin de ^{xvii}e siècle est au contraire une conception synthétique d'après laquelle la mathématique idéale serait une construction logique effectuée suivant des règles fixes sur des éléments fixes. Un passage spécialement intéressant de cette seconde partie c'est celui (p. 116-129) où M. BOUTROUX s'attache à montrer que la partie la plus féconde de la nouvelle mathématique créée par NEWTON et LEIBNIZ n'était point le calcul des différentielles ni le problème de l'intégration, mais la théorie des développements en série. Les algébristes du ^{xvii}e siècle se heurtaient au problème suivant : dans quelle mesure les fonctions transcendantes peuvent-elles être assimilées aux fonctions algébriques ? Ce problème, — cette crise — est heureusement comparée par l'auteur, à celle que durent résoudre les géomètres grecs lorsqu'ils se heurtèrent aux quantités irrationnelles.

Un troisième chapitre est consacré à l'étude de « l'apogée et du déclin de la conception synthétiste ». Je ne puis m'arrêter à tous les bons endroits, car ils sont trop nombreux. L'auteur commence par expliquer le développement au ^{xviii}e siècle de la synthèse algébrique-logique, c'est-à-dire l'extension naturelle et l'organisation systématique des grandes conquêtes du siècle précédent. La richesse des résultats obtenus suggère aux mathématiciens que cette méthode algébrique-logique est toute puissante; elle les amène à concevoir une mathématique parfaite qui serait « une science synthétique et mécanique dont les calculs s'effectueraient, pour ainsi dire, automatiquement »; certains finissent par s'imaginer que les théories mathématiques sont une création libre de leur esprit et ne sont d'ailleurs que des instruments de démonstration : ils cessent de croire à l'objectivité des mathématiques. M. BOUTROUX expose habilement ces excès intellectuels en nous faisant voir tout d'abord les limites de la logique, ensuite les limites de l'algèbre. Il nous donne ainsi une critique excellente et d'ailleurs très mesurée, du mouvement logistique. A titre d'exemple il examine la notion de *fonction* et montre nettement (p. 167) que « cette notion est avant tout pour le mathématicien, un indéfini, un indéterminé. L'idée que nous en avons est plus riche et plus pleine que toutes les définitions ou expressions que nous pouvons donner ou construire. Par conséquent une théorie logique des fonctions, quelque parfaite soit-elle... ne pourra jamais satisfaire la curiosité et les aspirations du mathématicien. Pour acquérir sur les fonctions des connaissances neuves et fécondes, il est indispensable de retoucher sans cesse les définitions et les principes sur lesquels on opère. En d'autres termes, les progrès les plus importants que réalisent les mathématiques sont

obtenus, non en perfectionnant la forme, mais en modifiant le fond de la théorie. Ces progrès ne sauraient être regardés comme étant d'ordre logique ».

La fin de cette citation nous donne en quelque sorte l'idée mère du livre, car sa brillante esquisse de l'analyse moderne fournit à M. BOUTROUX mainte occasion de montrer que dans l'incessant conflit entre l'invention et le développement purement déductif, c'est de plus en plus l'invention, c'est-à-dire, le choix en apparence arbitraire de nouveaux problèmes ou de nouveaux points de vue qui joue le rôle prépondérant. Nous revenons ainsi à l'attitude grecque, car le choix implique une contemplation, et si notre intuition nous permet de découvrir de nouveaux faits mathématiques, il faut bien admettre que ces faits existent en dehors de notre esprit, qu'ils sont doués d'une objectivité intrinsèque. La notion mathématique de *fonction* n'est que le reflet de la notion physique de *loi*. « La correspondance mathématique n'est pas une conséquence des opérations algébriques; elle est l'objet même qui les détermine » (p. 206) ⁽¹⁾. L'expression des faits mathématiques est nécessairement conventionnelle, mais les faits eux-mêmes ont une existence propre. Le géomètre ne les crée point; il les dévoile. — Il est possible toutefois que le contraste entre l'analyse du XIX^e siècle et celle des siècles précédents ne soit pas tout à fait aussi violent que l'auteur ne nous le fait croire. Sans doute la richesse des mathématiques modernes est si grande qu'elle nous donne parfois une apparence de désordre, et que le jeune mathématicien, doué d'imagination, est un peu comme un naturaliste dans un pays neuf. Mais cela n'est-il pas en partie une illusion due au fait que nous dominons les mathématiques du passé, tandis que nous sommes nous-mêmes dominés et pour ainsi dire écrasés par celles de l'avenir? Le conflit entre l'invention, l'exploration d'une part et d'autre part l'élaboration systématique, la construction logique n'est-il pas aussi vieux que la science? — Il faut concevoir le progrès des mathématiques (et de la science en général) comme une série de paliers de plus en plus élevés, interrompus par des rampes plus ou moins raides. Bien entendu si l'on regarde d'un peu plus près, on s'aperçoit que les rampes elles-mêmes ne sont qu'une succession de petits paliers, — les marches. Les inventions fondamentales semblent absolument différentes du labeur presque automatique qui se fait sur les grands paliers, mais la transi-

(1) Citons encore, p. 247 : « Il est impossible de considérer la mathématique comme le moule de la théorie physique, car il y a dans cette science même autre chose qu'un moule, il y a un fond objectif qui ne se laisse qu'incomplètement réduire en termes logiques ».

tion nous est donnée par les inventions secondaires, tertiaires, etc..., c'est-à-dire par des inventions de plus en plus concrètes et limitées.

Le livre de M. BOUTROUX est fort bien écrit et se lit avec beaucoup de plaisir. Peut être le chapitre IV, consacré à l'analyse moderne, aurait-il pu être un peu plus serré ; il ne me donne pas la même impression d'élégance que les autres. La seule objection de détail que je puisse faire m'est suggérée par la toute première page où l'auteur nous dit « que les mathématiques pures sont ni guidées par l'expérience, ni suscitées par les événements de la vie ». Voilà bien, un étrange *lapsus* et que du reste, la fin du livre dément. Ce n'est pas par hasard que certaines des plus grandes découvertes mathématiques ont été faites par des physiciens : ARCHIMÈDE, NEWTON, LAGRANGE, FOURIER... L'histoire nous enseigne que les différentes branches de la science ne progressent pas indépendamment. C'est d'ailleurs pour cela qu'il est utile d'étudier l'histoire de la Science, c'est-à-dire, l'histoire des interactions continues entre les diverses sciences. Il serait facile de montrer que presque toutes les inventions fondamentales de chaque science — toutes les grandes rampes dont je parlais tantôt — furent causées par de pareils phénomènes d'interaction. Il est indispensable de connaître l'histoire de la science pour comprendre le développement de chacune de ses branches.

G. SARTON.

Pierre Boutroux. *Les Principes de l'Analyse Mathématique* (exposé historique et critique), tome second, 460 p. chronological and historical notes (p. 461-482); Index (p. 483-507). Paris, Hermann et Fils, 1919.

The first volume of this work, which closes with « Book II, Chap. III, » has already been analysed in *Isis* (t. I, 1914. p. 734-742) by M. EMILE TURRIÈRE; and it has also been considered from a philosophical point of view in an editorial appearing in the same number above the signature of M. GEORGE SARTON. This first volume was divided into two Books; of which the first consisted of four chapters : « Les Nombres; » « Les Grandeurs; » « Les Figures; » « Le calcul algébrique; » and the second of three chapters : « Le calcul algébrique; » « Calcul des fonctions; » « Algèbre Géométrique; » under the main heading « Construction. »

The volume now under consideration starts with : « Livre Deuxième, chap. IV, Art. 579 »; so that it is a direct continuation of the first volume. It seems therefore a pity, as M. BOUTROUX considered it advisable to make the separation of his volumes take place in the middle of a Book, that a fresh pagination should be used for the

second volume. The separation here is justified, however, because in this chap. IV, the author leaves the algebraic view-point, and studies geometric figures « pour elles-mêmes ». He begins by pointing out that the application of arithmetic to geometry is as old as geometry itself, and that the fundamental metric theorems discussed in vol. I were the first-fruits of this application. Here we see the *motif* of the work: history, not for history's sake, but merely a tool to elucidate the progress of mathematical thought, to clarify the ideas underlying processes, and to promote development along similar lines.

Taking the contents of this volume in order, we have: (II, 4) « La géométrie algébrique ». In this the author, after a discussion of the reduction of geometric problems to a system of equations, proceeds to a consideration of the *Géométrie* of DESCARTES. Here M. BOUTROUX brings out well the point that made Cartesian geometry the important innovation that it was, namely, the fact that it was truly analytical. « L'équation d'une courbe renferme sous forme condensée, contient en puissance, toutes les propriétés de la figure; l'analyse les en fait sortir. » Further, it is pointed out that the order of the curve (*i. e.*, the number of possible intersections with a straight line) can by means of Cartesian geometry be made a matter of algebra; upon which point rests the possibility of an analytical infinitesimal calculus. The non-critical contents of this chapter serve as an excellent exposition of the facts and processes of elementary plane and solid coordinate geometry; with a section on the algebra of vectors of one dimension, and a brief mention of vectors of two and three dimensions, such as form the subject-matter of the *Ausdehnungslehre* of HERMANN GRASSMANN; and the chapter closes with a historico-critical discussion of descriptive (or synthetic) geometry, which leads to the consideration of linear and homographic transformations and the principle of duality, introduced by PONCELET and afterwards considered algebraically by PLÜCKER. In this chapter there is one point which I feel bound to criticize. M. BOUTROUX, in Art. 609, while calling attention to the fact that, if $F(x, y)$ is the *quotient* of $P(x, y)$ and $Q(x, y)$, then $F(x, y) = 0$ represents the same curve as $P(x, y) = 0$, whereas $(y - z) F(x, y) = 0$ represents the *two* curves $y - z = 0$ and $F(x, y) = 0$ together, yet states that equivalent algebraical equations represent the same curve. He misses the point for a quotient function, in which the *numerator and denominator have a common algebraical factor*. Thus, to take a very simple case, it should have been made clear that

$$I) \quad y(x - 2) = x^3 - 6x^2 + 11x - 6 = 0,$$

$$(II) \quad y = \frac{(x^3 - 6x^2 + 11x - 6)}{(x - 2)},$$

and (III) $y = x^2 - 4x + 3,$

represent three totally different things; and just where the equivalence is broken should have been pointed out. For (iii) represents a parabola, (i) the combination of this parabola with a parallel to the y -axis, while (ii) has an indefinite value for y for the value $x = 2$. These differences could have been brought out excellently by plotting curves for different values of a in the equation

$$y = \frac{(x^3 - 6x^2 + 21x - a)}{(x - 2)}$$

and observing the form of the curve as a approaches the value 6; or

similarly from $y = \frac{(x^3 - 6x^2 + 11x - 6)}{(x - b)}$ when b approaches the

value 2 from either side.

In (ii, 5), M. BOUTROUX returns to the algebraic view-point. He starts by discussing critically the extension of algebra to what he calls *synthèse algébrique-logique*; and points out that for the purpose under consideration the extension of the algebraic method is not along the natural line, but to a study of things of a new sort; — convergent algebraic expressions defined as the result of an infinite number of operations. The discussion of these is deferred till later; and a section on determinants follows, in which the fundamental properties are proved and the application to the solution of sets of linear equations is demonstrated. Then we have a section on complex numbers, as a preliminary to the discussion of points at infinity and imaginary figures, under the heading *géométrie irréal*; the usual transformation to homogeneous coordinates being very lucidly illustrated by point-correspondance between a plane and a certain spherical surface. Then we are led back once again to pure algebra and the theory of substitutions and groups comes under consideration, reference being made to the work of SOPHUS LIE. There follow sections on the logical construction of mathematics, the definition of number, DEDEKIND's theory; systems of geometry, Euclidean and non-Euclidean, coupled with the names of SACCHERI, LOBATSCHESKY and BOLYAI on the one hand, and RIEMANN on the other; an explanation of algebraic logic, coupled with the name of BOOLE, closes the chapter.

In (ii, 6), M. BOUTROUX leaves the domain of logic and returns to mathematical theory, and gives an account of the extension of the algebraic method to the consideration of series in which the number of operations is infinite. He first gives MERCATOR's series for $\log_e(1+x)$, and then passes on to NEWTON's generalization of the Binomial Theorem. The historical and critical accuracy of the work here, to my mind, suffers a temporary lapse; this is caused by (i) the deliberate rejection of the series of GREGORY and others as of no historical value,

and (ii) the description of NEWTON's work of discovery in an inverted order. For the first point, the publication, by so many persons, by very different methods, of infinite series, almost simultaneously, leads us to but one conclusion; namely, that the *time was ripe for the discussion of processes involving an infinite number of operations*. In this connection also, mention should have been made of the infinite continued products of WALLIS, the infinite continued fractions of BROUNCKER, and the « Arithmetical Tetragonism » of LEIBNIZ, who especially speaks of his own series, $\pi/4 = 1 - 1/3 + 1/5 - \dots$ (which by-the-way, was discovered and proved geometrically from a diagram of BARROW) as being a triumph, not because of the discovery itself, but because therewith a transcendent number was *for the first time expressed by means of natural numbers and the usual elementary operations of arithmetic*. As regards the second point, the inversion of the order of the description of NEWTON's work tends to throw a false-coloured light on the genius of NEWTON. M. BOUTROUX says « NEWTON fait une induction hardie »; he omits all mention of the real source from which the idea of the induction sprang — the *Arithmetica Infinitorum* of WALLIS, the inventor of the symbol ∞ . It was while studying this book that NEWTON turned his attention to formulae for interpolation; he especially tried for a means of interpolation for $\sqrt{1+x}$ as a mean between 1 and $1+x$, by studying the coefficients of $(1+x)^n$, set down in the tabular form used and fully explained by WALLIS in the *Arithmetica*, which forced NEWTON to the recognition of the factor $(m-p+1)/p$. As I have shown in another place, the whole of the generalization, the whole of the work, stood forth self-evident — not needing either the brain-power or the imagination of a NEWTON — to anyone definitely seeking for an interpolation formula, as soon as the tabular form had been filled up, after the manner of WALLIS, for the first few positive integral indices. NEWTON obtained the series for $\sqrt{1+x}$ in WALLIS' factor style for the coefficients, and verified it by the square root process for the first few terms; then the series for $(1+x)^{-1}$ or $1/(1+x)$, verified by division; after that series for indices $3/2$, $-1/2$, in each case verified; then, and not till then, did he dare to generalize, as any mathematician of his time would have done. NEWTON owed the Binomial Theorem to WALLIS, just as EULER owed his Gamma Function to WALLIS and BROUNCKER. Another point; unless my memory fails me, NEWTON had accomplished the inversion of his \sin^{-1} series, to yield a \sin series, by a process of gradual approximation, before he had fully developed his *Analysis per Aequationes*. The \sin^{-1} series was the first-fruit of the discovery of the Binomial expansion, combined with the differentiation and integration of an integral power of the variable, already known from WALLIS, and the fact that the differential coeffi-

cient of $\sin^{-1} x$ was $1/\sqrt{1-x^2}$, probably learnt from BARROW and a geometrical figure. Thus,

$$\text{if} \quad y = x + \frac{1}{2} \frac{x^3}{3} + \frac{3}{8} \frac{x^5}{5} + \frac{5}{16} \frac{x^7}{7} + \dots$$

$$\text{then} \quad x = y - \frac{1}{2} \frac{x^3}{3} - \frac{3}{8} \frac{x^5}{5} - \frac{5}{16} \frac{x^7}{7} + \dots \quad (\text{A})$$

A first approximation is $x = y$; put this in the second term of (A), and obtain a second approximation by omitting higher powers than the cube — i. e.,

$$x = y - \frac{1}{6} y^3$$

use the second approximation in the second term of (A), and the first in the third term, or, what comes to the same thing substitute the second approximation in the terms of (A) and omit powers that are higher than the fifth, and so obtain a third approximation in the form

$$x = y - \frac{1}{6} y^3 + \frac{1}{120} y^5$$

and so on. Now it is seen that by this method, the inverse series could only be obtained when y tends to x as x becomes small; thus we have the *motive* for the search for a *general* method, such as called forth the *Analysis per Aequationes*.

It is to be noted that M. BOUTROUX brings out the point that NEWTON and his contemporaries never bothered themselves with convergency while the series was being sought. After the series had been obtained, by no matter what means, all that remained was to determine whether the series was arithmetically intelligible. Thus we can imagine a NEWTON of today using divergent series in his research, obtaining a convergent series as a result in some special case, and being quite satisfied with it. This was the spirit of the induction used by WALLIS, which might have been put in words; « Nature never intended such a thing to be true in such a large number of cases, unless she intended it always to be true ». This was the spirit that led NEWTON, after verifying the truth of his interpolations for a number of cases, naturally and without any qualms to boldly generalize the Binomial expansion.

The second section of this chapter is naturally the consideration of tests of convergence of infinite series; and this just as naturally leads to a discussion of the circle of convergence, and TAYLOR's series; with this we come to the end of Book II.

Book III treats of « ANALYSIS »; and consists of four chapters dealing respectively with : — « *Analytic method in Mathematics* » « *Infinites* »

imal Analysis»; « *Analysis of the Principles of Mathematics* »; « *Analysis of the Notion of a Function* ». The first chapter consists of a single critical section which discusses the two great tendencies of altogether different character that actuate the mathematician; the contemplative tendency that seeks for development by the demonstration of new results, and the constructive tendency for which method is of paramount importance. From this there is a natural transition to the second chapter dealing with Infinitesimal Analysis; for the history of this is perhaps one of the most striking examples of the alternations of these two great tendencies. First the machinery and the notation is perfected; then comes the consideration of the axioms and the efforts to reduce these to a minimum; then the analysis of these axioms, such as the notion of continuity, to find out what is essential and what hypotheses are necessary and sufficient for the purpose in hand; finally, the very heart of the matter, the notion of function, is attacked. Thus, in the words of M. BOUTROUX, « L'analyse aboutit toujours à des constructions nouvelles. Elle ne rend pas la synthèse inutile, mais lui sert de préface et la conditionne. »

M. BOUTROUX opens his discussion, in chap. II, with CAVALIERI'S *Geometria Indivisibilibus*, and gives a clear account of the objections made to it by GULDIN, and the justification of his ideas by CAVALIERI in his *Exercitationes Sex*, a work published 12 years after the other. M. BOUTROUX, after giving the summation of the area under the parabolas ($y = x^n$), without mentioning the work of WALLIS, proceeds *per saltum* to the idea of a limit, coupled with the name of CAUCHY, a jump of at least 150 years. Surely it would be more in keeping with the spirit of this work to have followed the historical line and to have brought out the fact that CAUCHY « fut le premier à tirer au clair l'idée générale de limite », long after the calculus was fully developed as a tool in the hands of LEIBNIZ, the BERNOLLI and EULER. Leaving that as a debatable point, and acknowledging that after all M. BOUTROUX is the best judge of the order in which matter should appear in his own book, yet, having given such a lucid account of the notion of a limit, surely he might have spared us the confusing, if time honoured, symbolism, $0/0$, $0 \times \infty$, and the like, for indeterminate forms. I am far from being satisfied with Art 903, in which M. BOUTROUX deduces the conclusion that the sum of the rectangles under a curve has a limit *in general*, and that that limit is the area under the curve — a *general geometrical limit*, be it noted — from the arithmetical results obtained with regard to *special* curves. Especially so, since it would have been so easy to have demonstrated the matter *geometrically*, by transferring the limit of error, the difference between the inscribed and the circumscribed rectangle, for each pair of consecutive ordinates, to the space between

the ultimate pair of ordinates; and thus visualized the total limit of error as a rectangle of finite height standing on a base which diminishes indefinitely as the number of ordinates increases, and can be made smaller than any assignable length by taking the number of ordinates great enough. This would not only have brought the demonstration dead into line with the notion of limit already explained; but it would have also been historically accurate, for it is thus that both BARROW and NEWTON deal with it. But BARROW is not mentioned at all in the text of this volume; indeed, from the historical note on BARROW in the appendix, it would seem that M. BOUTROUX is not very familiar with BARROW's work. It is not the case that BARROW chiefly « s'occupa du problème inverse des tangentes »; the *Lectiones Geometricae* form, when translated into coordinate geometry, a complete text-book on the differentiation and integration of the functions then known, their products, etc., and a proof that differentiation and integration are inverses; all under the guise of the drawing of tangents and the finding of areas. Neither is it true that the collaboration of NEWTON extended beyond the second edition of the *Lectiones Opticae*, with which the first edition of the *Lectiones Geometricae* was bound up and issued as one volume. M. BOUTROUX, however, realizes that his assumption is unjustifiable as an assumption, and must be demonstrated in the general case. So, in Art. 908, he has recourse to an Archimedean type of proof which, in effect, defines the area under the curve by a method analogous to the Dedekindian definition of an irrational. He has two infinite series, one having no highest term, and the other no lowest term; and he shows that the area is greater than any term of the first series and less than any term of the second series, and therefore is a limit for either under the conditions of the problem.

Again, in my opinion, M. BOUTROUX altogether misses the meaning of the passage which he quotes from GERHARDT's edition of the early mathematical writings of LEIBNIZ. He attributes to LEIBNIZ the argument that d diminishes the dimensions because $d\alpha$ is infinitely small compared with α . Shades of LEIBNIZ! In the particular passage from which the quotation is made, dx , if it had occurred, would have denoted a rectangle! M. BOUTROUX's words are: « La somme \int , somme d'un nombre infini de termes, est infiniment grande par rapport à ses termes (elle est d'un *ordre de grandeur* supérieur, donc elle est finie si ses termes sont infiniment petits); la différence est infiniment petite par rapport à la quantité dont elle est l'accroissement (elle est d'un *ordre de grandeur* inférieur); ainsi écrit LEIBNIZ *ut \int augebit, ita d diminuet dimensiones* ». Either I must be mistaking the meaning of the above quotation, or else M. BOUTROUX has made a very bad error, and has got a totally wrong conception of the whole passage from

But, $DN : B(B) = DN : (D)N = BD : BT = y : d$ say, where d is the subtangent. But since $B(B)$ is unity, we have

$$w = DN = \frac{y}{d}, \text{ and therefore } l = \frac{ay}{d}.$$

« But », continues LEIBNIZ, « d signifies a difference... ». I think this is now plain; it is a contemplative note. LEIBNIZ, who is accustomed to writing down all his thoughts, *wonders* at the remarkable conclusion to which he has come : $\frac{y}{d} = w$, the difference between the y 's, which hitherto in his work on series he has always called dy ; « how then can $\frac{y}{d}$ and dy stand for the difference of the y 's? » This worries him, and later we find him trying to find a meaning for d as an operator, in a MS. dated November 11, 1675, where he considers whether $dx dy$ is the same as $d(xy)$, or $d\left(\frac{x}{y}\right)$ the same as $\frac{dx}{dy}$, i. e., in other words, is d distributive in a product and quotient as it is in a sum or difference? Further, with the explanation I have given of the passage (and I cannot see any other explanation that will make it continuous sense), LEIBNIZ gives an exact line for line analytical equivalent of Lect. X, Prop. 11 of BARROW'S *Lectiones Geometricae*, wherein is proved geometrically and rigorously that differentiation is the inverse of integration. Thus, read as I consider rightly, in this passage, LEIBNIZ gives for the first time a rigorous proof of an analytical nature for this proposition. For all we have to do is to put $B(B) = dx$ instead of unity; then, if we call the subtangent t instead of d to avoid confusion, we have $t = \frac{y}{(dy/dx)}$ instead of $\frac{y}{w}$; also $\int l$ becomes $\int l dx$, as afterwards used by LEIBNIZ. Then we have the theorem :

$$\text{If } \int l dx = ay; \text{ then } l = \frac{ay}{t} = a \frac{dy}{dx}$$

I have felt all the more bound to dwell at length on the point made above, because, in Art. 911, M. BOUTROUX argues, with some justice perhaps from one point of view, that the notion of function was more important than the technique of a calculus; while he asserts that the general theory of functions owes more to NEWTON than to LEIBNIZ. What then is left to LEIBNIZ? His notation only?

M. BOUTROUX, to my thinking, seems to have got a wrong impression of this early work of LEIBNIZ. For instance, in a footnote to Art. 914, he gives 1684 as the date of publication, in *Acta Eruditorum*, of LEIBNIZ' algorithm; but he does not state that in GERHARDT'S work on the early MS. of LEIBNIZ, which he has already quoted, there is given a full statement of the algorithm — i. e., for powers and roots as

well as for addition, subtraction, multiplication and division; the date of the MS. being July 11, 1677. Nor does he mention that of this there is a detailed revision, probably the rough draft from which the essay in *Acta Eruditorum* was worked up; in this LEIBNIZ, while he uses infinitesimals, has arguments and proofs that are geometrical, and it is the ratio of infinitesimals that is considered primarily. Again, in Art. 920, M. BOUTROUX is apparently following LEIBNIZ' development in the matter of differentials of the second order; and he mentions the strictures of NIEUWENTJIT. But he does not comment on the reply of LEIBNIZ (contained in the GERHARDT publication), in which proofs of the infinitesimal equalities are given by the use of (dx) , (dy) , (dz) , (dv) , *finite quantities which are taken proportional to* dx , dy , dz , dv . In this reply there is no use of anything of the nature of $\frac{d^2y}{dt^2}$; whereas we do have the use of $\frac{ddy}{ddx}$. Early in his work, November 1675, LEIBNIZ seems to be considering d as an operator, — for his d , owing to the fact that dx is considered as unity, is really $\frac{d}{dx}$; and later this idea seems to have been more insistent. This gives a more feasible origin for the symbolism $\frac{d^2y}{dx^2}$ than that given by M. BOUTROUX: thus: — ddy , or d^2y , with LEIBNIZ, since dz is the difference in the z 's corresponding to a small unit difference, dx , in the independent variable x , really means $\frac{d}{dx} \left(\frac{d}{dx} \right) y$, i. e., $\left(\frac{d}{dx} \right)^2 y$; and this is $\frac{d^2}{dx^2} y$ or $\frac{d^2y}{dx^2}$. In this reply too, LEIBNIZ states his Law of Continuity, and gives several examples of cases in which a limit of a sequence may sometimes be considered as a term of the sequence, at least in his opinion.

My reason for this lengthy criticism of this one section of M. BOUTROUX's work is that, although his separate sections are labelled analysis of this that and the other, his work is *tacitly*, and must be considered to be in its most important bearing, an *analysis of the progress of mathematical thought*. The work of LEIBNIZ is a condensed epitome of such progress, and no finer example could have been given. I should have liked to have seen at least twenty or thirty pages devoted to LEIBNIZ, and the comparison with his predecessors, contemporaries, and immediate successors; from this could have been deduced the manner in which discoveries are made, that they are made simultaneously by different men *when the time is ripe*, and that they are gradually led up to, even in the case of the work of one of the discoverers, by a *necessity*

for the first step, and after that, by suggestions and further necessities arising out of the work to which the first step is due.

The whole of M. BOUTROUX's rather laboured work on infinitesimals seems to me to have the aim of legitimatizing the separation of the variables in a differential equation, so that $P(x) = Q(y) \frac{dy}{dx}$ may be written as $P(x) dx = Q(y) dy$, and then integrated. But surely a better way of legitimatizing the work is to say that it is only a convenient device, and that what is really meant is represented as follows :

If $P(x) = Q(y) \frac{dy}{dx}$; then, on integrating with regard to x , we have

$$\int_{x_0}^x P(x) dx = \int_{x_0}^x Q(y) \frac{dy}{dx} dx ;$$

in which the factor $\frac{dy}{dx}$ (or as LEIBNIZ would have written it, $\frac{(dy)}{(dx)}$) is the finite ratio of the ordinate to the subtangent ; and thus $(dy) : (dx) = dy : dx$, that is to say, $\frac{(dy)}{(dx)} dx = dy$, where the dy and dx are the infinitesimals used in integration. Hence

$$\int_{x_0}^x P(x) dx = \int_{x=x_0}^{x=x} Q(y) dy = \int_{y=y_0}^{y=y} Q(y) dy$$

where (x_0, y_0) , (x, y) are corresponding values of the variables. Any-way, this is more in accordance with historical development : LEIBNIZ is continually hovering apparently between differentials and differential coefficients, and perhaps never attains really to NEWTON's supreme idea, the notion of rate ; but his ideas are at least direct and rigorous, though sometimes he cannot explain them clearly in his earlier work, on account of the fact, as noted before, that he takes dx as unity, which conceals the fact that, when he apparently uses infinitesimals, he is in reality using a differential coefficient.

I have spent so much time over this that I can only give brief notice to the remainder of the work ; which is perhaps the most important part of it. Sections 5 and 6 deal with definite integrals and line integrals ; with a discussion on the coefficients of FOURIER's series, in the first section, and a demonstration of the necessary and sufficient condition that a line integral should be independent of the form of the arc joining two given points, in the second section. Sections 7 and 8 discuss double and triple integration, and their application to areas and volumes. Sections 9 and 10 demonstrate the application of infinitesimals to geometry and mechanics ; in the latter, force is *defined* dynamically, *i.e.*, as something proportional to the acceleration, which is the first time-derivative of the velocity, this in turn being the first

time-derivative of some position abscissa; *i.e.*, NEWTON'S LAWS are taken as definitions of force. This last section closes chapter II.

Chapter III starts with a discussion on Continuity (§ 1, proceeds to aggregates (CANTOR, § 2), and discontinuity (RIEMANN, BAIRE, LEBESGUE, § 3). Section 4 deals with the fundamentals of geometry, the geometry of HILBERT, and the axiom of ARCHIMEDES; and closes a most important and well-handled chapter, which, however, might with advantage have been extended a little, as regards § 1, to include a note on LEIBNIZ' idea of continuity of *state* as contrasted with continuity of *matter* (with atomic theory; and *geometrical* continuity, giving as illustrations a discussion of the paradoxes of ZENO and the theory of BOSHCVIC.

Chapter IV opens with the contention that the fundamental general notion of a function depends on correspondence or relation. Then follows a long section, admirably treated, on the first principles of the theory of functions; this leads to sections on analytical functions and CAUCHY'S theorem, singularities, classification of functions, and periodic functions; and the volume closes with the Existence Theorem of CAUCHY.

There is an appendix giving short accounts of famous mathematicians in chronological order, which is distinctly useful. But surely it was unintentional to have omitted the name of TORRICELLI, who was important as a worker on the problem of tangents. Indeed, if we are to believe an almost contemporaneous account of the work of TORRICELLI, given by TOMMASO BONAVENTURA in 1715, as a preface to TORRICELLI'S *Lezione Accademiche*, the latter was the originator of the idea of indivisibles as ascribed to CAVALIERI. For we read: « in the Dialogues, which Father CAVALIERI had already prepared in reply to Father GULDINUS » (this would seem to refer to the *Exercitationes Sex*), « who in a book published by him just at this time, had violently attacked the doctrine of Torricelli » (the italics here are mine). BONAVENTURA goes to the length of accusing the French savants and BARROW of borrowing from TORRICELLI'S communications to them and publishing his theorems without acknowledgment. It would seem therefore that TORRICELLI should have had his name included in the list.

(Manchester, England.)

J. M. CHILD.

L. E. DICKSON. — *History of the Theory of Numbers* : VOL. II « Diophantine Analysis ». xxv + 803 p. Carnegie Institution of Washington, 1920.

This is the second volume of a work, of which the first volume has already been reviewed in *Isis* (iii, 446). What was said about the latter applies to the former, if indeed the second volume does not deserve higher praise than the first. As the title shows, it is solely confined

to the enormous and intensely interesting literature of Diophantine Analysis.

As in the case of the first volume, we have here a preface, of some ten to twelve thousand words, which might well stand, for most readers, as a concise history of the subject. The author therein states his point of view with regard to the aim of a historian; namely, to give a record of facts, with no attempt to follow out the sequence of deduction of these facts from earlier facts. He considers that « at least the germs of many important results are discovered by a sudden and mysterious intuition, perhaps the result of subconscious mental effort ». To the reviewer it appears that the whole of the truth in the passage cited above lies in the last six words, and that the rest is a direct contradiction to those six. Thus, in a history, it is the *sequence* of development of thought that is of paramount importance and the most valuable aid to further research. A new method in general arises from a more or less accidental *connection* of one man's method with another man's subject by a third man; the genius of the third man consists in the *capacity for observing that the connection is possible*; the rest is mere skill and erudition. As an illustration, take EULER's application of WALLIS' methods and BROUNCKER's Continued Fraction to the solution of the so-called PELL Equation, and the invention of the Beta and Gamma Functions. This capacity for observation of the possibility of a connection may be, most probably is, due to a lively and orderly subconsciousness. Surely, then, the more our third man knows of the *development of mathematical thought*, the greater chance there is that he may recognize the possibility of the connection.

However, the author has given us his work according to his own stand-point; and we are bound to accept this stand-point, if we propose to make use of his book or to criticize it; in this case, we can do nothing but give that praise which is so well-deserved by Prof. DICKSON and the mathematicians who have assisted him. At the very least, if in times to come some other author shall take in hand the writing of a history of the development of ideas in number theory, Prof. DICKSON will have saved him the work of years in the collection of material, and put him under an obligation which it would be almost an impertinence to consider was met by mere acknowledgment and thanks.

The table of contents is too long to be reproduced here; but modern interest is especially awakened over Chapter XXV (which gives an account of WARNING's Problem), owing to the recent work of G. H. HARDY and J. E. LITTLEWOOD. Chapter XXVI, forty-five pages on FERMAT's Last Theorem, will also appeal to many readers; especially owing to the report that, before these lines appear in print, a complete proof of the theorem will have been published.

J. M. CHILD.

Heinrich Wieleitner. *Geschichte der Mathematik*, II. Teil, II. Hälfte.
Sammlung Schubert, LXIV. vi+220 p. Berlin und Leipzig, 1921.
[In Germany, 45 Marks; in America, \$ 2.25].

This work is a continuation of the one begun some years ago by Prof GÜNTHER and BRAUNMÜHL, of which the first volume was completed by the former in 1908, after the death of the latter. It represents not merely the scholarship of Prof. WIELEITNER, but the care of ENESTRÖM and TROPFKE in reading the proof sheets. It may, therefore, be safely considered as a reliable work of reference. The author has divided his presentation of the subject into nine chapters relating respectively to (1) the analytic geometry of the plane, with special reference to conic sections; (2) solid analytic geometry and surfaces; (3) higher curves in general; (4) special curves; (5) differential geometry; (6) perspective, together with descriptive geometry; (7) projective geometry; (8) trigonometry; (9) elementary geometry. This is a large field to attempt to cover in such a small treatise, but the author, has been successful in condensing his presentation of the several topics and in giving a satisfactory survey that will be found helpful to students and teachers. Whether the great discrepancy between the German price and that which foreign scholars are asked to pay for the book will prove to be profitable to the publishers or the German government is very doubtful.

DAVID EUGENE SMITH.

Oscar [Christian Strange] Preisler [b. in Aarhus, Denmark, 1879, Jan. 6 — d. Kongens Lyngby, nr. Copenhagen, 1920, May 16].
Bibliographischer Führer durch die medizinische Literatur. Ein Grundriss. 87 p. gr. in-8°. Köbenhavn, Det akademiske antikvariat's haandbøger, 1920.

J. W. S. JOHNSON explains in a short Danish preface that the author had prepared this bibliographical introduction for publication in Germany, but that the war shattered his plans. After the death of the author, his widow intrusted the manuscript to J. W. S. JOHNSON, who under the new circumstances, decided to have it published in Denmark. The text is the original text, dated Sept. 1916, without any change or addition.

This bibliography seems to be very carefully compiled and it will prove useful, — much less however than if critical notes had been added to enable the reader to make a reasonable choice between so many items. The book is subdivided as follows : I. *Allgemeiner Teil* : Terminologia medica, Lexica; allgem. bio-bibliographische Werke;

Biographie. — II. *Spezieller Teil* : (1) Anatomie; (2) Mikroskopische Anatomie; (3) Anthropologie; (4) Entwicklungsgeschichte; (5) Biologie; (6) Biochemie; (7) Physiologie; (8) Allg. Pathologie und pathol. Anatomie; (9) Bakteriologie, Mikrobiologie und Parasitologie; (10) Immunitätsforschung. — III. *Spezielle Pathologie und Therapie* : (11) Innere Medizin; (12) Infektionskrankheiten; etc...; (33) Hygiene; (34) Soziale Medizin; (35) Gerichtliche Medizin.

Each section is divided into four subsections : (1) history; (2) bibliographies and annual reviews; (3) indexes to periodicals; (4) textbooks and monographies.

A final section (no 36) is devoted to the *history of medicine* (p. 75-85); it contains *inter alia* paragraphs devoted to the history of science in general, medicine and art, history of medical knowledge, history of the medical profession and teaching, history of the medical academies, anecdotes and curiosities; history of hospitals, popular medicine.

G. SARTON.

Dannemann, Friedrich. — *Die Naturwissenschaften in ihrer Entwicklung und in ihrem Zusammenhange.* 2^{te} Aufl. — I. Bd. Von den Anfängen bis zum Wiederaufleben der Wissenschaften. XII + 484 S., 64 Abb. Leipzig, ENGELMANN, 1920.

I have published a long review of the first edition of this work when its fourth and last volume appeared (1913) in *Isis*, II, 218-222. The first volume came out in 1910. Unfortunately I cannot compare the new edition with the old, for the latter disappeared from my Belgian library during the war. However comparing the new volume with my review of the old (*Revue générale des Sciences*, t. XXII, p. 931, 1911), I notice that the text has been materially increased (496 p. instead of 380) and that there have been some slight changes in the titles of the chapters. These titles are as follows in the new edition : (1) Origins of the sciences in Asia and Egypt; (2) Development of science in Greece until the time of ARISTOTLE; (3) The age of ARISTOTLE; (4) The Alexandrine period; (5) Roman science; (6) End of ancient science; (7) Decadence of sciences in the early Middle Ages; (8) The Arabic period; (9) Sciences under the influence of Christian-Germanic culture; (10) Renaissance of science; (11) COPERNIC; (12) The reconstruction of the inorganic sciences. In short these 500 p. take one from prehistoric times until the days of GALILEO. That may seem a very swift progress, yet DANNEMAN's is the most elaborate history thus far in existence! Is any other proof needed to show that our studies are still in their infancy?

The value of this new edition is increased by the collaboration of

E. WIEDEMANN, E. v. LIPPMANN and J. WÜRSCHMIDT. Many *errata* and *addenda* mostly contributed by them are given on p. 478-484. Because of WIEDEMANN's collaboration, I turned with special eagerness to the chapter devoted to what is improperly called Arabic (instead of Mohammedan) science (1), but this chapter does not seem to me very different from the old one? May be I am wrong, for I have to depend on my memory. At any rate we would expect more from the learned Arabic scholar of Erlangen. — In my first review, I complained that the account of EUCLID's work was insufficient: has any material change been made? at any rate the account is still very meager.

Of course the reader must not forget the limitations to which the author had to submit himself: to tell the whole history of all sciences from the beginning of civilization to the xviiith century in 500 pages is a sort of a wager. The result however good cannot interest the scholar. Taking these limitations into account, DANNEMANN's book is satisfactory; in fact it is by far the best of its kind and as such it would be useful to translate it into English.

G. SARTON.

Zeitlinger, Heinrich. *Bibliotheca Chemico-Mathematica.* Catalogue of works in many tongues on exact and applied science. With 127 plates containing 247 portraits and fac-similes, 2 vol., xii+964 p. London, HENRY SOTHERAN, 1921 [3 guineas]

A very interesting catalogue of books for sale by the well-known London firm, SOTHERAN & Co. It contains 17,397 items, many of which are followed by short biographical and bibliographical notes and is richly illustrated by 247 portraits and fac-similes. This is certainly the largest bibliography of its kind which has thus far appeared.

This is about the most that can be said in praise of this trade catalogue. Unfortunately, there is very much to say against it, and it must be said, the more so that the price of this book is extravagantly high.

For one thing, this is not by any means a complete list for it contains only the items which happen to be for sale at SOTHERAN'S. Neither is it critical, for anything which is for sale is considered quotable, and but for the accidental annotations (many of which deal with trivial or unessential matters), all items are put on the same level. Of course

(1) The more so that some of the greatest scientists of Islam were distinctly *not* Arabs.

a bookseller is more interested in mere bibliographic rarity and monetary value than in intrinsic value. Yet as a price list this catalogue is and will remain a very interesting document. In the second place, although there is a useful subject index, there is no author index. Now the general arrangement of the book is as follows. There is a first list of 284 p. (5602 items), the authors being quoted in alphabetical order. Then follows a supplement (p. 285-786) and further *addenda* (p. 786-788) in the same order. Finally a new list classified by subjects: general works, mathematics, astronomy and geodesy, physics etc., the authors being quoted in alphabetic order under each heading. Hence to find *ex. gr.* CANTOR's books we have to look into four or five different parts of the book. And what shall we find: (1) on p. 34, mention of CANTOR's *Vorlesungen*, first vol. of the first ed. only, without any explanation; (2) on p. 343 a mention of the same work, first ed. of vol. I and II, 2nd ed. of vol. III with the note: « The standard work on the history of mathematics, indispensable to any good scientific library »; (3) in the further *addenda*, no CANTOR; (4) on p. 798, a mention of the same work, the latest ed. of the 4 volumes at last, with a note repeating the preceding one and adding the name of the contributors to vol. IV. That is, after having looked in four different places, I have found three items referring to the same work (of which two were incomplete) and I have found no mention of any other work or paper of CANTOR!

Of course any such large accumulation of titles can but prove useful once in a while, but I have said enough to show that it must be used with great circumspection. The collection of plates illustrating the book is most interesting and forms in my opinion, its most valuable feature.

GEORGE SARTON.

Aldo Mieli (editor). — *Gli scienziati italiani dall' inizio del medio-evo ai nostri giorni*. Repertorio biobibliografico dei filosofici, matematici, astronomi, fisici, chimici, naturalisti, biologi, medici, geografi italiani. Volume I. Parte I. VIII + 236 p., 47 fig., 28 × 20 cm. Roma, NARDECCHIA, 1921.

I have already explained the aim and method of this very remarkable collection in *Isis*, III, 59. Suffice it to add that the promises made by the editor have been kept and that the first installment of his great undertaking is an auspicious beginning. Of course when judging this collection we must take into account the fact that it is the result of a very free collaboration; we can not expect every article to be on the same level. There are many portraits and autographs and the biblio-

graphical and iconographical notes seem to have been prepared with great care. I quote below in chronological order the scientists included in this first volume, adding the name of the author of each notice.

XIII (1)

FIBONACCI, LEONARDO, mathematician (GINO LORIA).

XVI (9)

ALPINO, PROSPERO (1553-1616), botanist (A. BÉGUINOT).

ANGUILLARA, LUIGI (or LUIGI SQUALERMO), (c. 1512-1570) botanist (G. B. DE TONI).

BIRINGUCCIO, VANNOCCIO (1480-1539?), chemist, mining engineer (MIELI).

GHINI, LUCA, (c. 1490-1550) botanist (G. B. DE TONI).

GUILANDINO MELCHIORRE, (c. 1520-1589) botanist (G. B. DE TONI).

MAGINI, GIOV. ANT., (1555-1617) astronomer (A. FAVARO).

MARANTA, BARTOL., (c. 1500-1571) physician, botanist (G. B. DE TONI).

MOLETTI, GIUSEPPE (1531-1588), astronomer (A. FAVARO).

SILVESTRI, FRANCESCO (1474-1528), philosopher (GIAC. SESTILI).

XVII (5)

BARANZANO, REDENTO (1590-1622), philos., astronomer (G. BOFFITO).

BERTINI, ANTON FRANC. (1658-1726) physician (A. CORSINI).

CESTONI, DIACINTO (1637-1718), naturalist (G. STEFANINI).

FOLLI, FRANCISCO (1623-1685), physician, naturalist (G. GORETTI-MINIATI).

RIVA, GIOV. GUGL. (1627-1677) anatomist, surgeon (C. ARTOM).

XVIII (7)

BERTINI, G. M. S. (1695-1756), physician (A. CORSINI).

CHIARUGI, VINCENZO (1759-1820), physician, psychiatrist (A. VEDRANI).

COCCHI, ANT. (1695-1758) physician (A. CORSINI).

CORTI, BONAVENTURA (1729-1813), botanist (G. B. DE TONI).

COTUGNO, DOMEN. (1736-1822), physician (G. BILANCIONI).

PONTERERA, GIULIO (1688-1757), botanist (A. BÉGUINOT).

VALLI, EUSEBIO (1755-1816), physician (A. VEDRANI).

XIX (13)

ACRI, FRANCESCO (1779-1851), philosopher (E. P. LAMANNA).

AMICI, GIOV. BAT. (1786-1863) physicist, naturalist (G. B. DE TONI).

BERTINI, GIUS. (1772-1845) physician, hist. of medicine (A. CORSINI).

DE VISIANI, ROBERTO (1800-1878), botanist (A. BÉGUINOT).

DINI, ULISSE (1845-1918), mathematician (G. LORIA).

FIGARI-bey, ANT. (1804-1870), traveller, naturalist (G. STEFANINI).

INGHIRAMI, GIOV. (1779-1851), astronomer (P. G. GIOVANNOZZI).

PASSERINI, GIOV. (1816-1893), botanist (G. B. DE TONI).

PICCONE, ANT. (1844-1901), botanist (G. B. DE TONI).

REGALIA, ETT. (1842-1914) ethnologist (N. PUCCIONI).

SCHIAPARELLI, GIOV. VIRG. (1835-1910) astronomer (E. MILLOSEVICH).

STERZI, GIUS. (1876-1919), anatomist (G. FAVARO).

ZANARDINI, GIOV. (1804-1878) physician, botanist (G. B. DE TONI).

The various branches of science and the various periods are fairly well represented in this volume, although it is remarkable that one third of the scientists are botanists, and more than one third belong to the nineteenth century. The editor should concentrate his effort on the older scientists, for it is exceedingly difficult to see a contemporary in his proper perspective. At any rate, we must be grateful to him for all that he is offering us, *and every encouragement should be given to him* in order that the undertaking may be carried on with reasonable speed.

The biography of ETTORE REGALIA by NELLO PUCCIONI (p. 196-202) is quoted neither in the table of contents, nor in the list of collaborators.

SARTON.

R. Paucot. — *Le rôle des sciences dans l'éducation*, 255 p. (180 × 120).
Paris, A. COLIN, 1920. [6 fr. 50]

Il est vraiment étrange de constater que, tandis que la vie de l'homme est de plus en plus conditionnée par les applications des découvertes scientifiques, tandis que les différentes écoles philosophiques s'imprègnent de plus en plus de la pensée scientifique proprement dite, la place laissée à l'étude des sciences dans les programmes officiels d'instruction de nos pays d'Europe reste encore lamentablement mesurée. Mais le fait est là : si les mathématiques y ont depuis longtemps une place honorable, si leur valeur éducative est reconnue, les sciences physiques et naturelles ne sont entrées dans les programmes que par la petite porte, et ne sont guère enseignées que dans un but d'utilisation pratique, et non en vue de la culture intellectuelle qu'elles sont à même de développer.

Étant entendu que l'éducation doit armer l'enfant, l'adolescent et l'homme au triple point de vue physique, intellectuel et moral, on a jusqu'à présent considéré que le développement intellectuel et moral ne pouvait être le fait que d'une éducation littéraire, et il est certes bien peu d'établissements d'instruction où l'enseignement de la morale par exemple, soit confié à un professeur de l'ordre des sciences ; nous n'en connaissons qu'un pour notre part.

La place laissée aux études scientifiques est non seulement extrême-

ment réduite, mais encore souvent, dans l'enseignement primaire tout au moins, à l'âge où l'esprit d'observation est si vif, où pourrait se cultiver si utilement la mémoire visuelle dans les « leçons de choses », cet enseignement scientifique est en général très mal donné, en raison de la formation défectueuse des maîtres qui se trouvent chargés de la mission la plus délicate que la société puisse confier à des hommes.

M. PAUCOT demande dans son ouvrage une « collaboration » des lettres et des sciences à l'œuvre de l'enseignement. Il montre excellemment comment, selon l'âge et le développement intellectuel du travailleur, doivent être enseignées les mathématiques, les sciences physico-chimiques et la biologie pour fournir le meilleur rendement en vue de la culture générale des individus. Son livre ne renferme rien qui n'ait déjà été dit, mais ce déjà dit se trouve ici condensé sous une forme élégante, et exprimé avec une chaleur que nous aimerions à voir convaincre, et ceux qui enseignent, et plus encore ceux qui ont la grave mission d'élaborer les programmes d'instruction.

L. GUINET.

M. Leclerc du Sablon. — *L'unité de la science*, 284 p. (185×120). Paris, FÉLIX ALCAN (Nouvelle collection scientifique), 1919 [4 fr. 90]

Ensemble de considérations sur le principe de causalité, la causalité inverse, la non réversibilité des phénomènes, et les principes directeurs de l'arithmétique, de la géométrie, de la cristallographie, de la mécanique, de l'astronomie, de la physique, de la chimie, de la bioénergétique, de l'excitabilité de la matière vivante, de la morphologie et des sciences morales! Chacun de ces chapitres constitue à son tour une mosaïque un peu étrange de laquelle il est difficile de dégager une idée directrice autre que celle-ci : toute science a pour origine des observations sensorielles, s'édifie par application constante des deux postulats de causalité et de causalité inverse, auxquels l'intention de quelques hommes de génie ajoute d'autres postulats particuliers. De ci de là sont heureusement rappelés quelques points particuliers d'histoire de la connaissance scientifique telle par exemple celle des étapes de la découverte par Galilée de la loi de la chute des graves.

L. GUINET.

Fr. Houssay. [1860-1920]. — *Force et Cause*, 210 p. (185×120). Paris, E. FLAMMARION (Bibl. de philos. scientif.) 1920. [5 fr. 75]

On sait avec quel succès FR. HOUSSAY, allant plus avant dans la voie déterministe que ne le font les théories lamarckiennes, n'attendant de

l'animal « qu'une énergie motrice et une plasticité suffisantes », a introduit depuis vingt ans la méthode mécanique en biologie.

Ses principaux ouvrages : *La forme et la vie* (1900), *Nature et Sciences naturelles* (1907), *La morphologie dynamique* (1911), *Forme, puissance et stabilité des poissons* (1912), marquent, en dehors de ses communications aux sociétés savantes, les étapes parcourues, et ce dernier livre, de recherche théorique pure, peut être considéré comme le bréviaire des travailleurs dans cet ordre d'idées si fécond.

M. HOUSSAY, hier encore Doyen de la Faculté des Sciences de Paris nous a donné dans son dernier livre : *Force et Cause* la trame essentielle de sa philosophie scientifique, et bien que l'esprit en soit fort différent, ou ne peut se retenir de comparer ce petit livre à *L'Introduction à l'étude de la médecine expérimentale*, de CLAUDE BERNARD. C'est dire qu'en faire un compte-rendu fidèle est chose impossible : le moindre paragraphe est un sujet de méditation. Aussi nous contenterons-nous de suivre la Table des matières.

Le livre est divisé en deux parties dont la première a pour titre : « Connaissance et réalité ».

I. Les diverses formes de la connaissance. — II. Les idées et les faits : faits et objets résultent d'une discontinuité artificielle, sont des créations de notre esprit. — III. La connaissance scientifique : science ou sciences; la science est langage, elle est aussi pénétration du réel dans l'esprit. — IV. Les sciences naturelles : l'abstraction en biologie; le vivant, la forme individuelle, l'espèce; les combinaisons de ces concepts. — V. Le temps, l'espace et le mouvement : espace géométrique et espace mécanique; l'espace des phénomènes est réellement à quatre dimensions; sa décomposition en deux autres. — Vision et souvenir : cinématographie et méthode graphique. — Confusion ou distinction entre les deux espaces; la distinction s'impose en face des durées géologiques; la figuration du temps en stratigraphie; arbres généalogiques et évolution des formes. — VI. Les échelles du temps. Évolution et création : changements astronomiques et temps périodique, changements géologiques et temps évolutif; les deux sortes de temps sont pratiquement incommensurables; création évolutive et non évolution créatrice. — VII. Sur la causalité. Force et matière : force et cause; matérialisme, idéalisme; dans le dynamisme, la masse est subordonnée, et la causalité apparaît sous la forme de la force : tous les phénomènes sont réductibles à la force dirigée. — VIII. La causalité en biologie : la réduction du continu en discontinu (les atomes biologiques) a échoué en biologie; la notion d'irréversibilité doit remplacer celle de contingence; le déterminisme scientifique s'oppose à toute idée de hasard, mais à rien d'autre; la science doit arriver à la

causalité en remontant la voie de l'efficience. — IX. La finalité en biologie : la finalité introduit les notions d'utile et de nuisible qu'ignore le déterminisme ; les thèses qui se réclament de DARWIN sont encore finalistes ; la recherche de l'efficience fait retrouver le déterminisme ; la finalité repoussée de chaque détail est reportée sur la synthèse terminale : la pensée primordiale, qui échappe à l'espace et au temps, qui est capable de produire une force, de la diriger, est à la fois efficiente et finale.

La seconde partie, intitulée « Le monde, la vie, la pensée », renferme, en un raccourci saisissant, un tableau brossé en grandes masses, des étapes par lesquelles est passé notre ancêtre arboricole et frugivore avant d'atteindre le stade d'homme actuel.

I. L'évolution de la vie et la réhabilitation d'énergie : si on n'étudie pas exclusivement l'animal supérieur adulte, la vie apparaît comme une réhabilitation d'énergie mécanique et d'énergie psychique. — II. Incarnation de l'énergie mécanique : les formes et les structures sont les conséquences et non les causes de la vie ; exemple de la forme des poissons, de la constitution des muscles et des fibres musculaires ; la constitution et le fonctionnement d'une forme animale, même compliquée, se ramènent à une succession physico-chimique et mécanique. — III. Sur l'énergie psychique : tandis que la plupart des actes vitaux sont des réactions physico-chimiques, on trouve chez les animaux supérieurs, en plus, la conscience et la pensée ; c'est une nouvelle réhabilitation d'énergie. — IV. Énergie psychique et individualité : équivalence de l'énergie psychique avec les autres énergies ; sa conservation. — V. Premiers effets de l'énergie psychique dans le régime frugivore : le régime frugivore tend à développer les qualités de prévoyance et d'ingéniosité ; notre ancêtre potier, boulanger et vigneron. — VI. Orientation des idées originelles par le régime alimentaire : des germinations se produisant dans les provisions de fruits et de graines, la notion de germe apparaît, qui se rattache au concept de vie ; génération et genèse ; création et créateur. — VII. L'évolution de la bonté : connaissance de la nature et réaction sentimentale ; l'élevage des jeunes crée des amitiés durables ; le don de soi dans la famille et dans la vie sociale ; l'examen cinématique des choses montre la bonté émergeant des luttes et des immolations ; certes, il reste encore du mal, mais la peine est la condition formelle de tout perfectionnement. — VIII. Évolution et progrès : vis-à-vis du progrès, l'évolution est oscillante. — IX. Progrès et adaptation. L'idée d'adaptation, la notion d'optimisme doit remplacer celle du progrès ; le seul indiscutable progrès est l'introduction de l'intelligence et de la bonté, et c'est là encore une réhabilitation d'énergie.

L. GUINET (Bruxelles).

Naville, Adrien. — *Classification des sciences. Les idées maîtresses des sciences et leurs rapports*, 3^e édition, entièrement renouvelée, iv+322 p. Paris, ALCAN, 1920.

Les diverses classifications des sciences peuvent se diviser en deux groupes fondamentaux : les classifications objectives, c'est-à-dire celles qui insistent surtout sur la nature des objets dont traitent les sciences et les classifications subjectives, c'est-à-dire celles qui considèrent plutôt la part de l'esprit dans la création des disciplines. Les classifications de BENTHAM, d'AMPÈRE, d'ERNEST NAVILLE (le père d'ADRIEN), d'A. RAVA, et aussi celle de WUNDT appartiennent au premier groupe; tandis que celles de FRANÇOIS BACON, de D'ALEMBERT, de COMTE et de COURNOT appartiennent au second. La nouvelle classification d'ADRIEN NAVILLE (je dis nouvelle, car ses idées ont évolué sur ce sujet, et en 1877 il enseignait à Neuchâtel une classification tout autre), quoique profondément différente de celles de COMTE et de COURNOT, est aussi une classification subjective.

L'auteur considère qu'il y a trois questions scientifiques fondamentales : 1^o quelles sont les possibilités conditionnées par les natures permanentes des choses et quelles sont les relations nécessaires entre ces possibilités ? 2^o quels sont les faits réels et quelles sont les possibilités concrètes conditionnées par ces faits ? 3^o quelles sont les possibilités bonnes ? Ou plus brièvement : Qu'est-ce qui est possible ? Qu'est-ce qui est réel ? Qu'est-ce qui est bon ? A ces trois questions, répondent trois classes de sciences : a) les sciences de lois, *Théorématique*; b) les sciences de faits, *Histoire*; c) les sciences de règles, *Canonique*. L'objet du livre est de développer cette classification. Je n'essayerai point de le résumer. L'examen des diverses branches de la science, et surtout des problèmes fondamentaux de chacune d'elles, donne à l'auteur maintes occasions de prouver la richesse de ses connaissances, la prudence de son esprit et la douce sagesse de son cœur. Je ne pense pas que les classifications des sciences soient fort utiles, mais si elles n'avaient d'autre utilité que de nous obliger à faire ainsi un examen d'ensemble des richesses intellectuelles qui sont le plus précieux patrimoine de l'humanité, elles justifieraient déjà leur existence. La lecture d'un livre comme celui-ci se recommande surtout aux jeunes étudiants; il les aidera puissamment à trouver leur voie dans la vie.

GEORGE SARTON.

Westaway, F. W. — *Scientific Method*. Its philosophy and its practice. New edition. xxiv+426 p.; *Science and Theology*. Their common aims and methods, xiv+346 p. London, BLACKIE, 1919-1920.

It is convenient to examine these two books together, for they have essentially the same purpose and much else in common. The first is more elementary and but little scientific knowledge is needed to understand it, while the other will be read with profit only by advanced students.

The first book is divided into four main parts:

1. *The philosophy of scientific method*: A short history of the philosophy of science, special chapters being devoted to SOCRATES, PLATO, ARISTOTLE, scholasticism, BACON, DESCARTES, LOCKE, HUME. Apropos of the latter the views of causation held by many other thinkers are discussed.

2. *The logic of scientific method*: An interesting study of the main logical problems involved in the elaboration of science. It is very concrete and very simple and is based chiefly upon the writings of WHEWELL, MILL, JOHN HERSCHELL, ALEX. BAIN, WILL. STANLEY JEVONS, WELTON, ALFRED SEDGWICK, of whom biographical sketches are given. It is a pity that these sketches are so meager; if introduced at all, they should have been far better.

3. *Famous men of science and their methods*: A series of extracts from scientific writings with brief introductory notes. The author gives examples first of scientific observation, then of various experiments of increasing complexity. These extracts are produced in the following order: WHITE of Selborne, A. R. WALLACE, DARWIN, Lord AVEBURY, HARVEY, WILL. CHARLES WELLS, BLACK, PRIESTLEY, GAY-LUSSAC, DAVY, BOYLE, NEWTON, FARADAY. These examples are certainly interesting and instructive, but their choice is not altogether satisfactory. The author should have been able to find a series of illustrations in which the methodological order was not so much at variance with the chronological order.

4. *Scientific method in the class room*: Elementary principles of scientific teaching and instances of investigations attempted by pupils.

In short, this book contains excellent stuff, and I recommend it to the teachers of elementary science and philosophy. They will find in it many interesting facts and suggestive thoughts (for ex. on p. 199. the criticism of NEWTON's optical research). But it is not on the whole a good book; the author himself could have given us a much better one if he had taken more trouble to compose it well. It

is a valuable collection of good pieces — some are excellent — poorly put together.

WESTAWAY'S second book is far superior; though it falls short of being excellent because of a similar inadequacy in the general composition. One must fully admire the extensiveness and the soundness of his knowledge and the wisdom of which he gives many a proof, but the general plan of his work could have been improved and some discursiveness avoided. The book — considering its real date 1919, and the speed of discovery in our days — is remarkably uptodate. The best informed reader will find in it, explained in a clear and pleasant manner, some new information. Of course the fundamental objection to such a book is that it is suggestive only to the extent of the reader's previous knowledge. It is very difficult to imagine what it may convey to the mind of an ignorant theologian, and yet the author seems sometimes to assume that readers without scientific training may read it; I fear that to the untrained reader it would prove more dangerous than useful.

The purpose as defined in the preface, is: (1) to show on what evidence some of the fundamental principles of science have been established, and to make clear that these principles are provisional only; (2) to present a picture of the structure and evolution of the universe as conceived in the light of recent discoveries; (3) to show that modern science has become a great fundamental factor in human life and progress; (4) to show that permanent and final truth, whether in science or in theology, is very rare and very hard to come by and that what we call truth is usually an affair of a greater or less degree of probability; and finally (5) to appeal to each and every branch of the Christian church to abandon its claim to be the special favourites of heaven and to present a united front to the common enemy.

After a very careful reading of the book, I gladly acknowledge that the author's manifold purpose has been remarkably accomplished. However, I would have liked him to insist more upon the fact that our knowledge, if necessarily imperfect and provisional, is progressive. We cannot reach the absolute truth, but we come increasingly nearer to it. Science advances slowly but surely by a method of successive approximations, and judging from the incredible progress made during the last century, no one can imagine how much further we will be able to proceed in the future. If we could imagine our ignorance, we would already be less ignorant; we can only conceive it to the extent that we have overcome it.

The plan of the book is as follows: (1) The problems of philosophy; (2) Opinion and truth; (3) Matter; (4) Infinity, space and time; (5) Genesis of the Earth; (6) Evolution of animal species; (7) Evolu-

tion and antiquity of man; (8) Life and consciousness; (9) Instinct and intuition; (10) Probability; (11) Causation; (12) Theology and religion.

The author's theological conclusions are the broadest, and his insistence upon the fact that theology should be founded upon sound scientific knowledge and developed with the assistance of the true scientific spirit and methods is splendid. Says he (p. 343): « The important thing is for those in authority to keep themselves free from all moorings and afloat; to realize that religious truth has still to be found and their greatest duty of all is to devote their lives to the search for it. » That is splendid, but how many theologians will understand it? and of these, how many will have the energy and the perseverance to follow the author on his arduous path?

WESTAWAY concludes, on p. 110, that « the notion of infinite space conflicts with the conception of the universe as a whole, and the notion of infinite time with that of the universe as a process. All hypotheses of evolution imply that the universe had a beginning in time... » but he adds wisely at the end: « So far as space is concerned, RIEMANN'S idea of space curvature may after all, form a clue to the ultimate solution of the problem. But time is admittedly one-dimensional, and no intelligible hypothesis which would enable us to form a conception of the *beginning* of time has yet been put forward. Yet nothing can be urged in favour of the infinity of time or space except a disability of our imperfect thought. At bottom, it is merely a question of a lack of correspondence between the constitution of our minds and that of the Universe. Why should we regard such a conflict as necessarily permanent? Why should not the conflict cease when in the course of ages, the human mind more closely approaches its evolutionary goal? » (1).

The chapter on Causation was largely rewritten on the appearance of C. A. MERCIER'S book, *Causation and Belief*. « Modern conceptions of energy now make inevitable, however regretfully, the final abandonment of the main positions of HUME and MILL » (p. 279).

The lack of an index is to be deprecated; the author's theological friends will stand greatly in need of it. Select bibliographies are given at the end of each chapter, but without places and dates. The only blemish of this book is an irrelevant reference to COMTE on p. 15.

(1) Apropos of this I would remark : (1) with regard to time — that the notion of *periodical* evolution may help to reconcile the notions of evolution and infinity; (2) with regard to space — that EINSTEIN'S theory implies the assumption of space curvature, that is, of a finite universe. WESTAWAY, writing in Nov. 1919, did not yet accept the theory of relativity.

The non-English reader should remember that the author uses the words billion, trillion, etc., according to English usage. In England a billion is 10^{12} , in France and America, 10^9 . This confusion is very annoying. The author acknowledges his special debt to the late Lord RAYLEIGH, « whose invaluable help was most ungrudgingly given for many years. »

WESTAWAY'S second book is very good indeed.

GEORGE SARTON.

Sand, René. *Organisation industrielle, médecine sociale et éducation civique en Angleterre et aux Etats-Unis*, 896 p. Bruxelles, LAMERTIN et Paris, BAILLIÈRE, 1920. [30 fr.]

This report which contains the results of Dr SAND's investigations in England and in the United States during the war is a fundamental contribution to the *organization* of social medicine and of positive polity and as such it deserves to be reviewed in *Isis*. It is really an encyclopædic survey, the more so that the author has added the essential bibliography of each topic to the record of his personal observations. Dr SAND is especially interested in the subject of social medicine, but it is of course impossible to draw the line on one side between social medicine and the organization of industry, and on the other, between social medicine and civic education. This determined the three main divisions of this book : Industry, Medicine, Education.

The very comprehensiveness of this survey makes it impossible even to quote the many topics which are dealt with. I think that more importance should have been given to the two following problems. In the first place, the sterilization of born criminals and other disgenic people should have been discussed more fully. In the second place, considering the primordial value of milk in human diet, it would have been worth while to explain with more detail the production and distribution of good milk in the great American cities. A paragraph should have been devoted to a discussion of the use of condensed and powdered milk. In the chapter dealing with orphans and abandoned children, I should have liked to find at least some reference to the growing practice among Americans to adopt children even when they already have many of their own. This trait of civic idealism is very characteristic. In the Latin countries adoption is considerably restricted by the *Code Napoléon*, whose chief object is the protection of personal property.

From the historical point of view, I have only two remarks to make. The statement on p. 548 : *l'introduction de la syphilis en Europe par les matelots de CHRISTOPHE COLOMB* is unwarranted ; as it is also irrele-

vant, it would have been wiser to leave it out. RAMAZZINI's *de morbis artificum diatriba* was first published in 1700, not in 1730. — It is a pity that many of the small diagrams are not more legible.

The reading of this book gave me great pleasure. It is gratifying to contemplate human achievements, but the planning of these achievements is far more gratifying. No field opens a brighter prospect of the future than social medicine. It is tremendously exciting to think of all the great things which could be done if scientific methods were more systematically applied to the solution of social problems and if the traditional politicians could be replaced by engineers and physicians.

It is interesting to anticipate the future of medicine along these lines. The nineteenth century had witnessed an increasing specialization of the medical profession and the gradual driving back of the general practitioner. But we now attend a new development: on the one hand, specialization becomes more and more necessary and new kinds of specialists are born every day; on the other hand the notion of preventive medicine is constantly gaining ground as civic idealism develops. These two simultaneous tendencies, specialization and prevention, can but lead to an enormous development of the collective (*vs.* the private) practice of medicine. Only few people will have sufficient means to submit themselves periodically to the various *preventive* examinations which an increased enlightenment and a deeper sense of social duty will make more and more compulsory. As I see it, this will not decrease but on the contrary upraise the importance of the general practitioner, who will remain the trusted family adviser on all medical matters and will be the connecting link between the public and the numerous specialists. To be able to give sound advice to his clients and to send them in time to the proper specialist, the practitioner will require a solid medical and scientific training. It will no longer be necessary for him to know the practical details of many techniques, but on the other hand, he will need a more encyclopædic and deeper knowledge of the principles of every branch of medicine.

One must be thankful to Dr SAND for having written this excellent book. By doing so he has rendered a great service to the Latin countries, and also indirectly to the Anglo-Saxon world whose idealism is so often misunderstood. Dr SAND has not lost his time in discussing the reality and the value of their idealism; he has preferred to oblige his reader to witness the immense amount of social service which this idealism has inspired. He has made it clear that poverty and misery will be defeated only by the alliance of civic idealism with scientific knowledge.

GEORGE SARTON.

Tenth Critical Bibliography

of the History, Philosophy and Organization of Science
and of the History of Civilization

(to April 1921)

This Tenth Bibliography contains about 752 notes and refers to more than a thousand publications. It is not yet complete and on the other hand it contains the titles of various books or papers published many years ago. Thus, it is very far from being normal, although it marks a great progress upon the previous ones.

Some of the notes have been contributed by J. L. E. DREYER (Oxford), L. GUINET (Brussels), L. C. KARPINSKI (Ann Arbor, Mich.), P. MASSON-OURSSEL (Paris).

The arrangement and leading principles of this bibliography have been fully explained in *Isis* III, 159-171. The complete plan of classification follows. The reader will keep in mind that Part I is the fundamental classification and that Parts II and III contain only such items which could not be included in Part I because they deal with periods longer than two centuries (1). That is, Part II is only the residue of Part I, and Part III is only the residue of Parts I and II.

PART I. — FUNDAMENTAL CLASSIFICATION (CENTURIAL).

..., S VIII A. C., S VII A. C., ..., S I A. C., S. I, S II, ..., S. XX.

The last subdivision is followed by a list of biographical, chiefly obituary, notices entitled « Materials for the biography of contemporary scientists and scholars ».

(1) Items dealing with periods longer than one century and shorter than three, are classified under one of the two centuries they deal with : the most important, or if equally important, the earliest.

PART II. — HISTORICAL CLASSIFICATION.

- | | |
|--------------------------------------|------------------|
| 1. Antiquity. | 9. Greece. |
| 2. Antiquity, classical. | 10. India. |
| 3. Asia (Central, Eastern, Western). | 11. Iran. |
| 4. Babylonia and Assyria. | 12. Islam. |
| 5. Bible (Old Test. civil). | 13. Israel. |
| 6. Byzantium. | 14. Japan. |
| 7. China. | 15. Middle Ages. |
| 8. Egypt. | 16. Rome. |

PART. III. — SYSTEMATIC CLASSIFICATION

- | | |
|--|---|
| 1. Anatomy. | 18. Logic and theory of knowledge. |
| 2. Anthropology. | 19. Mathematics. |
| 3. Archæology, museums and collections. | 20. Mechanics. |
| 4. Art, art and science, iconography. | 21. Medicine : a) Hist., Organisation and Philos.
b) Epidemiology. |
| 5. Arts and Crafts. | 22. Morals. Moral organ. of society. |
| 6. Astronomy, geodesy, meteorology and terrestrial physics. | 23. Pharmacy, pharmacology. |
| 7. Bibliography and libraries. | 24. Philosophy. Science and philosophy. |
| 8. Biology. | 25. Physics. |
| 9. Botany. | 26. Physiology. |
| 10. Chemistry. | 27. Prehistory. |
| 11. Economics (econ. doctrines and hist., commerce, transportation, communications). | 28. Psychology. |
| 12. Education (methods and institutions.) | 29. Religion. Science and religion. |
| 13. Ethnology, primitive and popular science. | 30. Science : a) Bibliography.
b) History.
c) Organization.
d) Philosophy. |
| 14. Geography. | 31. Sociology, jurisprudence and positive polity. |
| 15. Geology, mineralogy, palæontology and mining. | 32. Statistics. |
| 16. History of civilization. History, methods, biography and chronology. | 33. Superstitions and occultism. |
| 17. Language and literature. | 34. Technology. |
| | 35. Zoology. |
| | 36. Alia. |

I may add that I am preparing an "Introduction to the History and Philosophy of Science", which will contain a critical and synthetic bibliography of the whole field (see *Isis*, IV, 23-31). When this Introduction is published (in 1923?) the Critical Bibliographies appearing in *Isis* will be, so to say, periodical supplements to it. It is hoped that the scholars who do not yet see the value of our classification, will understand it better when this Introduction will have enabled them to survey with comparative ease the whole field of scientific endeavour throughout the ages.

As my friend ALDO MIELI edits an excellent bibliography of Italian publications in his *Archivio di Storia della Scienza* (Roma, Nardecchia; vol. II, no 2-3 appeared in June 1921), — a bibliography which is also fundamentally chronological, — I will not duplicate his effort and will quote in my own bibliography only the most important Italian publications.

I am anxious to obtain the assistance of more collaborators in order that this bibliography be as good as possible. I would be especially grateful to scholars who would undertake to sub-edit one of the chapters, *ex. gr.* Greece, or Middle Ages, or astronomy, or botany. The best result would be obtained if every special chapter were edited by a specialist. But that would require teamwork of the first class, and the more so that Parts II and III should remain subordinate to Part I. There are still other ways to collaborate to this bibliography: one may undertake to analyze a certain number of periodicals, or else send in separate notes at random.

Scholars whose books or memoirs have not yet been included in this bibliography should not hasten to blame the editor. Did they send them to him? Or if they did, were their contributions pertinent? They should put themselves in the place of the editor whose chief aim is to establish the History of Science as an independent discipline and to serve best the scholars engaged in these studies. Critical work must be approached in a spirit of service or left untouched.

Cambridge, Mass. 24 Agassiz st.

May 19, 1921

GEORGE SARTON.

PART I

Fundamental Classification (centurial)

S. IX. A.C.

Allen, Thomas William. The Homeric catalogue of ships edited with a commentary [*Iliad*, II, 494-877], xi + 191 p. Oxford, CLARENDON Press, 1921. 1918

Wilamowitz-Moellendorff, Ulrich von. Die Ilias und HOMER, vi + 524 S. Berlin, WEIDMANN, 1916. 1918

S. V. A.C.

Beardslee, John Walter (jr.). The use of φύσις in fifth century Greek literature (*Thesis*), 126 p. Chicago University Press, 1918. 1918

Diels, H. Hippokratische Forschungen. V. Eine neue Fassung des XIX HIPPOKRATES-Briefes. *Hermes*, Bd. 53, p. 57-87. Berlin, 1918. 1918

Fotheringham, J. K. A neglected eclipse. *The Observatory*, vol. 43, p. 189-191, 1920. 1918

The total eclipse of — 462 April 30, alluded to by PINDAR. J. L. E. D.

Halliday, W. R. The first description of a Lake-Village. *Discovery*, vol. I, p. 235-238. London, 1920. 1918

This description is found in HERODOTUS (V. 16); it is probably the only first-hand description from life of one of the lake-villages of the Central European type exactly similar to those in which the ancestors of the Romans must once have lived. HALLIDAY gives a general account of lake-villages with bibliography. G. S.

Murray, Gilbert. ARISTOPHANES and the war party. A study in the contemporary criticism of the war party (The CREIGHTON lecture, 1918). 48 p. London, ALLEN, 1918. 1918

The American ed. of the same book is entitled : *Our great war and the great war of the ancient Greeks*. New York, SELTZER, 1920. G. S.

Obst, Ernst. Die Beschreibung des Nilpferdes bei HERODOT II, 71. *Klio*, t. 14, p. 390-391. Leipzig, 1914. 1918

Pohlenz, Max. Zu den hippokratischen Briefen. *Hermes*, t. 52, 348-353. Berlin, 1917. 1918

Based upon Papyri Berol. 6934 and 7094 of the VIII cent. and Pap. Ox. IX, 1184 of the time of TIBERIUS. G. S.

Pohlenz, M. Das zwanzigste Kapitel von HIPPOKRATES *de prisca medicina*. *Hermes*, Bd. 53, p. 396-421. Berlin, 1918. 1918

Westberg, Fr. Zur Topographie des HERODOT, III, 7. Herodots Stadion. *Klio*, t. 14, p. 338-344. Leipzig, 1914. 1918

Conclusion : Herodotus' stadium = 148,85 m.

G. S.

Zilles, W. HIPPIAS aus Elis. *Hermes*, Bd. 53, p. 45-56. Berlin 1918.

1818

Information on the life and activity of HIPPIAS the sophist, supplementing that given by GOMPERZ. No reference to his mathematical work. G. S.

S. IV A. C.

Bitterauf, Karl E. Der Schlussteil der Aristotelischen Biologie. Beiträge zur Textgeschichte und Textkritik der Schrift *de generatione animalium*. (*Progr.*), 48 p. Kempten im Allgäu, 1913.

1818

A second part, which I have not seen, has been published *ibidem* 1914, 33 p. G. S.

Cajori, Florian. ARISTOTLE and GALILEO on falling bodies. *Science*, t. 51, p. 615-616, 1920.

1818

CAJORI discusses fully ARISTOTLE's ideas on the subject. G. S.

Herzog, M. A. ARISTOTELES' Anschauungen über die Lehre von Winterschlaf im Vergleich zu unsern heutigen Kenntnissen. Festschrift für ZSCHOKKE, n° 41, 28 p. Basel, 1920.

1818

An elaborate study of ARISTOTLE's views on hibernation followed by a summary of modern ideas on sleep and winter sleep, and a bibliography.

G. S.

Mathieu, Georges. ARISTOTE. Constitution d'Athènes. Essai sur la méthode suivie par ARISTOTE dans la discussion des textes. (Bibliothèque de l'école des hautes études, sci. histor. et philol., fasc. 216), VII + 137 p. Paris, CHAMPION, 1915.

1818

Taylor, Alfred Ewart. ARISTOTLE (The People's Books). Revised ed., 126 p. Edinburgh. JACK, 1919. (First ed. 1912).

1818

Wellmann, M. Eine pythagoreische Urkunde des IV. Jahrhunderts v. Chr. *Hermes*, Bd. 54, p. 225-248. Berlin, 1919.

1818

Apropos of a text quoted by DIOGENES LAERTIUS (VIII, 25 sq.), which has not received sufficient attention, because it is anonymous. ZELLER alone (*Phil. der Griechen*, III, 2^a, p. 103 sq.) has seen its importance, but he has erroneously attributed it to the last quarter of the second century. WELLMANN maintains that it is a Pythagorean writing of the 4th cent. B. C. He gives the full text. G. S.

S. III A. C.

Archibald, R. C. The cattle problem of ARCHIMEDES. *The American mathematical monthly*, vol. 25, p. 411-414, 1918.

1818

Bosmans, H. Sur les recherches relatives à l'histoire de la formation des Eléments d'EUCLIDE, à propos des derniers travaux de ZEUTHEN. *Revue des questions scientifiques*, 11 p. Bruxelles, avril 1920.

1818

Caspari, Fritz. Das Nilschiff PTOLEMAIOS IV. *Jarbuch des Kaiserlich deutschen archäologischen Instituts*, Bd. 31, p. 1-74, 1 pl. Berlin 1916.

1818

Apropos of the immense floating palace built for **PTOLEMY PHILOPATER** (221-205) and described by **CALLIXENUS** of Rhodes, his contemporary (**ATHENAEUS**, V). G. S.

Jastrow, Morris (jr.). A gentle cynic : being a translation of the book of Koheleth, commonly called *Ecclesiastes*, stripped of its later editions ; also its origin, growth and interpretation, 255 p. Philadelphia, LIPPINCOTT, 1919. 1818

Heath, Sir Thomas L. EUCLID in Greek. Book I, with introduction and notes, x + 240 p. Cambridge University Press, 1920. 1818

Payn, H. The well of ERATOSTHENES. *The Observatory*, vol. 37, p. 92-98. 1 pl., 1914. 1818

A picture of a well on the island of Elephantine. J. L. E. DREYER (*ibidem*, p. 352-353), shows that the well cannot have had any connection with ERATOSTHENES. J. L. E. D.

S. II A. C.

Erkes, Eduard. Das Weltbild des HUAI-NAN-TZE. *Ostasiatische Zeitschrift*, V, p. 27-80, 13 Abb. Berlin 1917. 1818

HUAI-NAN-TZŭ, the last early Taoist philosopher, died in 122 B. C. He wrote a compilation in 21 books, of which book IV dealing with the surface of the earth, is here translated with copious annotations. The illustr. are photographs of the Chinese text. G. S.

Feldhaus, F. M. Eine phantastische Wasseruhr. *Geschichtsblätter für Technik*, t. II, p. 22-24, 143-144, mit Abb. Berlin, 1915. 1818

About the monumental but fanciful reconstruction of CTESIBIUS' water-clock in "Deutsches Museum", Munich. This model is 3.50 m. high ; its mechanism is entirely modern. G. S.

Fotheringham, J. K. The secular acceleration of the sun as determined from HIPPARCHUS' equinox observations, with a note on PTOLEMY's false equinox. *Monthly notices of the R. astronomical soc.*, vol. 78, p. 406-423, 1918. 1818

Discusses 20 equinox determinations made by HIPPARCHUS and compares them with NEWCOMB's tables of the Sun. J. L. E. D.

Fotheringham, J. K. The new star of HIPPARCHUS and the dates of birth and accession of MITHRIDATES. *Monthly not. of the R. astron. soc.*, vol. 79, p. 162-167, 1919. 1818

This new star is identical with the comet of B. C. 134, said by JUSTIN to have heralded the conception of MITHRIDATES, while another comet which appeared at his accession was seen according to a Chinese source in B. C. 120. J. L. E. D.

Lippmann, Edm. O. von. Geschichtlicher Beitrag zur Erkenntnis der Verbrennungsvorgänge. *Z. für angew. Chemie*, Bd. I, Dez. 1920. 1818

Shows that the ancient knew that air is indispensable to the process of combustion. Deals chiefly with PHILO of Byzantium. G. S.

- [**Philo of Byzantium.**] PHILONS Belopoiika (viertes Buch der Mechanik) Griechisch und Deutsch von H. DIELS und E. SCHRAMM. Mit 8 Tafeln. 68 S. *Abhdl. d. Preuss. Ak. d. Wiss., philos.-hist. Klasse*, nr 16. Berlin, 1919. 1818

The Greek text is based upon that published by RICHARD SCHOENE. PHILO's treatise on war engines is far less clear than HERO's but has the advantage of containing measurements of the machines described. The authors have taken special pains to insure the correctness of their translation from the technical point of view. The plates are very good; six of them are borrowed from E. SCHRAMM, *Die antiken Geschütze der Saalburg*, Berlin 1918. G. S.

- Viedebantt, O.** Der athenische Volksbeschluss über Mass und Gewicht. *Hermes*, 51 Bd., p. 120-144. Berlin 1916. 1819

New study of the inscription CIG, 123, of the end of the second cent. B. C. G. S.

S. I A. C.

- Diels, H.** LUKREZ studien. II, III. *Sitzungsber. d. preuss. Akad. d. Wiss.*, 2-18. Berlin, 1920. 1818

- Musschl, J.** Über eine Aporie in der Lehre von den Aggregatzuständen bei LUKREZ (II, 444-477). *Hermes*, Bd. 53, p. 197-210, Berlin, 1918. 1818

- Preisigke, Friedrich und Spiegelberg, Wilh.** Die Prinz Joachim Ostraka. Griechische und demotische Beisetzungsurkunden für Ibis- und Falkenmumien (*Schriften d. wissensch. Gesell. in Strassburg*, 19. Heft), vii + 69 S., 4 T., 1914. 1818

- Stern, E. von.** Bemerkungen zu STRABONS Geographie der taurischen Chersonesos (mit einer Kartenskizze) *Hermes*, Bd. 52, p. 1-38. Berlin, 1917. 1818

S. I

- Charles, Robert Henry.** A critical and exegetical commentary on the revelation of St. JOHN. 2 vol. (International critical commentary). New-York, SCRIBNERS, 1920. 1818

- Dessau, H.** Über die Abfassungszeit einiger Schriften SENECAS. *Hermes*, t. 53, p. 188-196. Berlin, 1918. 1818

- Foakes-Jackson, Frederic John and Lake, Kirsopp.** The beginnings of Christianity. Part I. The Acts of the Apostles. Vol. I. Prolegomena. I, The Jewish, Gentile and Christian backgrounds. xi+480 p. London, MACMILLAN, 1920. 1818

- Holland, Francis Caldwell.** SENECA, 206 p. London. LONGMANS 1920.

- Manilius.** *Astronomica* edidit JACOBUS VAN WAGENINGEN, xxvi + 196 p. Leipzig, TEUBNER, 1915. 1818

Translation into Dutch of the same work by the same author. Leiden, BRILL, 1914 (not seen). G. S.

Meyer, Eduard. APOLLONIOS von Tyana und die Biographie des PHILOSTRATOS. *Hermes*, Bd. 52, p. 371-424, Berlin, 1917. 1818

MEYER's conclusion is that APOLLONIUS was a personality of no importance in his time. The main writers of the second century ignore him, LUCIAN refers to him with contempt. His fame is due entirely to PHILOSTRATUS' romantic biography. — This conclusion is of course not new, but it is interesting to have it restated by EDUARD MEYER. G. S.

Mutschmann, Hermann. SENECA und EPIKUR. *Hermes*, Bd. 50, p. 321-356. Berlin, 1915. 1818

Nachmanson, Ernst. EROTIANSTUDIEN. (Arbeten utg. med understöd af VILHELM EKMANS universitetsfond, 19), xv + 574 p. Uppsala 1917. 1818

Neuburger, Max. Die Medizin im FLAVIUS JOSEPHUS, 74 p. Bad Reichenhall, 1919. 1818

Summers, Walter Coventry. The silver age of Latin literature from TIBERIUS to TRAJAN, xii + 323 p. London, METHUEN, 1920. 1818

Wellmann, M. PAMPHILOS. *Hermes*, t. 51, p. 1-64, Berlin, 1916. 1818
Study of the sources of CLAUDIUS AELIANUS' περί ἑσώων ιδιότητος.
G. S.

Wissowa, Georg. Die Abfassungszeit der Chorographia des POMPONIUS MELIA. *Hermes*, 51 Bd., p. 89-96. Berlin, 1916. 1818

S. II

Dreyer, J. L. E. On the origin of PTOLEMY's catalogue of stars. *Monthly notices of the R. astron. soc.*, vol. 77, p. 528-539, 1917: vol. 78, p. 343-349, 1918. 1818

It was not borrowed from the catalogue of HIPPARCHUS which only contained about 850 stars nor from observations made by MENELAUS. — The error of a degree in the longitudes of PTOLEMY's catalogue was caused by an error in his equinox due to his having adopted too large a value of the length of the tropical year. The declinations of 18 stars given by PTOLEMY were certainly observed by him. J. L. E. D.

Fischer, Jos. Die Stadtzeichen auf den PTOLEMÄUSkarten. *Kartographische und schulgeographische Zeitschrift*, VII. Jahrg., p. 49-52, 3 Fig. Wien, 1918. 1818

Fischer, Jos. PAPPUS und die PTOLEMÄUS karten. *Zeitschrift der Gesellschaft für Erdkunde*, Berlin, 1919, p. 336-358. 1818

In 1881 father ARSÈNE SOUKRY published in Venice the « *Géographie de Moïse de Corène, d'après PTOLEMÉE. Texte arménien traduit en français.* » This Armenian MOSES fl. ab. 440 according to SOUKRY, but other authors would consider his Geography as an apocryphal writing of the viiith, ixth or even xth century. At any rate this Armenian geography is based upon a lost work of PAPPUS. The Rev. Dr JOS. FISCHER contends that PAPPUS, who fl. but a little more than a century later than PTOLEMY and was working in the same place and along the same lines as his great predecessor, actually used PTOLEMY's maps. He proves it by comparing MOSES' (that is PAPPUS') text with the Ptolemaic maps. G. S.

Fotheringham, J. K. and Longbottom. The secular acceleration of the Moon's mean motion as determined from the occultations in the *Almagest*. *Monthly Notices of the R. astronomical soc.*, vol. 75, p. 377-394, 1915. ISIS

See *ibidem*, p. 397-398, note by E. B. KNOBEL : the earliest use of one of these occultations was by N. GREENWOOD in his *Astronomia Anglicana*, 1689; also p. 589, note by J. K. FOTHERINGHAM on SCHJELLERUP's discussion of the occultations in the *Almagest* (in *Copernicus*, I, p. 25-39, 1881); E. NEVILL. On the conjunctions of stars with the Moon recorded by PTOLEMY (calls attention to SCHJELLERUP's discussion); p. 716, reply by FOTHERINGHAM. J. L. E. D.

Fotheringham, J. K. Ancient observations of coloured stars. *The Observatory*, vol. 43, p. 191-192, 1920. ISIS

Review of a paper by FRANZ BOLL on the starcolours described in PTOLEMY's *Tetrabiblos* and other ancient writings. J. L. E. D.

Hellmann, G. Über die ägyptischen Witterungsangaben im Kalender von CLAUDIUS PTOLEMAEUS. *Sitzungsber. d. Kgl. preuss. Akad. d. Wiss.*, p. 332-341. Berlin, 1916. ISIS

Helmreich, G. Handschriftliche Verbesserungen zu dem HIPPOKRATES-glossar des GALEN. *Sitzungsber. d. Kgl. preuss. Ak. d. Wiss.*, p. 197-214. Berlin, 1916. ISIS

Pelliot, Paul. MEOU-TSEU ou les doutes levés. Traduit et annoté. *T'oung Pao*, vol. XIX, p. 255-433. Leide, 1920. ISIS

MEOU-TSEU probablement né vers 165-170 à T'sang-wou, où se trouve actuellement Wou-tcheou sur le Si-Kiang, s'était retiré au Tonkin avec sa mère sans doute dès avant 189. Dès son séjour au Tonkin, semble-t-il, il s'était épris du bouddhisme. PAUL PELLIOT traduit ici un petit traité d'apologétique bouddhiste qui lui est attribué. Cette traduction est accompagnée d'une longue introduction (p. 255-286) et de notes copieuses (p. 326-433). PELLIOT pense que le Meou-tseu date de la fin du II^e siècle, sans exclure tout à fait l'hypothèse d'un faux ultérieur (IV^e ou V^e siècle). D. TOKIWA (1920) avait conclu indépendamment que c'est un faux du V^e siècle — On sait que le Bouddhisme fut probablement introduit en Chine au I^{er} siècle de notre ère. G. S.

Platnauer, Maurice. The life and reign of the emperor SEPTIMIUS SEVERUS [146-211, emperor 193-211], VI + 221 p. Oxford, University Press, 1918. ISIS

Schöne, Hermann. τὸ τοῦ Τραϊανοῦ γυμνάσιον bei GALENOS. *Hermes*, Bd. 52, p. 105-111. Berlin, 1917. ISIS

Apropos of the gymnasium of TRAJANUS mentioned in GALEN's Θεραπευτικὴ μέθοδος, XIII, c. 15 (X, p. 909-916, Kühn). This gymnasium must be the *thermae* constructed under TRAJANUS by APOLLODORUS of Damascus. G. S.

Tudeer, Lauri O. Th. On the origin of the maps attached to PTOLEMY's geography. *Journal of Hellenic Studies*, t. 37, p. 62-76, London, 1917. ISIS

Wenkebach, Ernst. Pseudogalenische Kommentare zu den Epidemien des HIPPOKRATES. *Abh. d. Kgl. preuss. Akad. d. Wiss., philos.-hist. Klasse*, Jahrgang 1917, n^o 1, 62 p. Berlin, 1917. ISIS

The text included in KÜHN's ed., t. 17, 313-462 (GALEN's commentary to the 2nd. book on epidemics) is a cento of the xvth or xvith century made up of quotations from HIPPOCRATES and GALEN and of others translated from FORTIS' Latin commentaries of 1560 and 1588. This text should be excluded from the Corpus Medic. Graec. G. S.

Wenkebach, Ernst. Das Proömium der Kommentare GALENS zu den Epidemien des HIPPOKRATES. *Abhdl. d. Kgl. preuss. Akad. d. Wiss., philos.-hist. Kl.*, 55 p., nr. 8. Berlin, 1918. 1818

Wenkebach, Ernst. Eine alexandrinische Buchfelle um einen Buchstaben in den hippokratischen Krankengeschichten. Ein unveröffentlichtes GALENkapitel. *Sitzungsber. d. preuss. Akad. d. Wiss.*, p. 241-253, Berlin, 1920. 1818

S. III

Fischer, Jos. PAPPUS und die PTOLEMÄUSKARTEN, *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, p. 336-358, 1919. 1818

See analysis under S. II.

S. IV

Alfaric, Prosper. L'évolution intellectuelle de saint AUGUSTIN. Tome I. Du manichéisme au néoplatonisme, ix+556 p. Paris, Nourry, 1918. 1818

Bidez, J. L'évolution de la politique de l'empereur JULIEN en matière religieuse. *Bull. de l'Acad. roy. de Belgique (classe des lettres)* n° 7, p. 406-461. Bruxelles, 1914. 1818

Explains on first-hand evidence religious evolution at a fateful hour, justifies JULIAN against those who slandered him and shows that his efforts were not vain. G. S.

Haarhoff, Theodore. The schools of Gaul. A study of pagan and Christian education in the last century of the Western empire. Oxford University Press, 1920. 1818

Mackean, W. H. Christian monasticism in Egypt to the close of the fourth century. Studies in church history, 160 p. London, Society for promoting Christian knowledge, 1920. 1818

After two introductory chapters dealing respectively with « Christian monasticism and non-Christian ascetic systems (Indian, Greek, Egyptian, Jewish) », and « the origin of Christian monasticism in Egypt », the author makes a closer study of the various types and aspects of Egyptian monasticism, chiefly in the ivth century, and of its spread. Bibliography and index. G. S.

Nemesii Episcopi Premon physicon sive περί φύσεως ἀνθρώπου liber a N. ALFANO archiepiscopo Salerni in latinum translatus, recognovit CAROLUS BURKHARD, xii + 154 p. Leipzig, TEUBNER, 1917. 1818

S. VI

Diels, H. Ueber die von PROKOP beschriebene Kunststhr von Gaza. Mit einem Anhang enthaltend Text und Uebersetzung der ἑκφρασις

ὠρολόγιου des PROKOPIOS von Gaza. *Abh. d. Kgl. preuss. Akad. d. Wiss., philos.-hist. Kl.*, nr 7, 39 p., 2 pl. Berlin, 1917. 1818

The description of the clock of Gaza by PROCOPIUS (this text was formerly attributed to CHORIKIUS) is particularly interesting, meager as it be from the technical point of view, because it is one of the last monuments of Greek art and ingenuity, and because it marks a transition between the clocks of CTESIBIUS and the Christian and Islamic clocks. PROCOPIUS is to be placed between 473 and 535, for he seems to have died before 536. DIELS has tried to reconstruct the clock of Gaza. G. S.

S. VII

Helmreich, G. Handschriftliche Studien zu MELETIUS. *Abhdl. d. Kgl. Preuss. Ak. d. Wiss., J.* 1918, *philos.-hist. Kl.*, nr. 6, 62 p. Berlin, 1918. 1818

The περί φύσεως ἀνθρώπου of the Phrygian monk MELETIUS was published in 1836, by CRAMER (*Anecd. graec. Oxon.*, III, p. 1-157) but this edition is not satisfactory. HELMREICH publishes here the results of research preparatory to a new edition. At the end of his memoir he gives lists of the words borrowed by MELETIUS from NEMESIUS, GALEN, GREGORY OF NYSSA, BASILIUS, GREGORY NAZIANZEN. According to VOIGT and WINTER (as quoted in NEUBURGER and PAGEL's *Handbuch d. Gesch. d. Med.*, t. I, p. 558) MELETIUS the monk fl. between 600 and 800. G. S.

With, Karl. Buddhistische Plastik in Japan, bis in den Beginn des 8. Jahrhunderts n. Chr. Textband mit 28 Abbild., 207 S.; Tafelband mit 224 Taf. nach eigenen Aufnahmen des Herausgebers, Gr.-4°. Wien, SCHROLL, 1919. 1818

This study of early Japanese sculpture down to the beg. of the Tempyō does not reveal monuments not yet published in Japan, but it is valuable because of the many illustrations relating to sculptural details and also because it is extremely handy. The text consists mainly of a description and stylistic analysis of each plate. The subject is divided as follows: (I) First half of viith century; (II) Second half of viith century; (III) First half of viiith century. — This is to my knowledge, the first complete analysis of pre-Tempyō sculpture published in Europe. G. S.

S. VIII

Browne, George Forrest [1833-]. The venerable BEDE. His life and writings, 327 p., 20 pl. Society for the promotion of Christian knowledge. London, 1919. 1818

This life by Bishop BROWNE first appeared in 1879. G. S.

Lindsay, Wallace-Martin. Notae latinae. An account of abbreviation in Latin MSS. of the early minuscule period (c. 700-850); xxiv+500 p. Cambridge University Press, 1915. 1818

S. IX

Lehmann, Paul. Zur Kenntnis und Geschichte einiger JOHANNES SCOTUS zugeschriebener Werke. *Hermes*, Bd. 52, p. 112-124, Berlin, 1917. 1818

(I) Die Disputatio IOHANNIS SCOTTI cum THEODORO GRAECO und die Clavis physicae des HONORIUS AUGUSTODUNENSIS; (II) De egressu et regressu animae ad Deum, de visione Dei und die Uebersetzung der Ambigua MAXIMI; (III) Aus der Bibliothek eines Freundes des JOHANNES SCOTTUS. G. S.

S. X

[Fārâbî, al. b. at Fârâb (i.e. Otrar), Turkestan, ab. 870 — died in Damascus. 950-951]. ALFARABI über den Ursprung der Wissenschaften (*de ortu scientiarum*), hrg. von CLEMENS BAEUMKER. *Beiträge zur Geschichte der Philosophie des Mittelalters*, XIX, 3. 32 p. Münster i. W., 1916. 1818

Text of the Latin-translation most probably by DOMINICUS GUNDISSALINUS, archdeacon of Segovia (middle of xiith cent.) : Liber ALPHARABII de ortu scientiarum. Epistola de assignanda causa ex qua ortae sunt scientiae philosophiae et ordo earum in disciplina. Introduction of 13 p. G.S.

S. XI

Wilhelm, Friedrich. Denkmäler deutscher Prosa des 11. und 12. Jahrhunderts. Mit Kommentar und Einleitung versehen. 2 vol. (Münchener Texte, 8), München, CALLWEY, 1914-1918. 1818

S. XII

Lippmann, Edmund O. von. Zur Geschichte des Alkohols. *Chemiker-Zeitung*, nr. 102, 1920. (Reprint, 1 1/2 p.) 1818

Completing previous notes on same subject, see *Isis* III, p. 322, 323, 324. The oldest mention of alcoholic distillation is found in the writings of the so-called Magister SALERNUS who died in 1167. Now the great Breslau *Compendium of Salernitan medicine* compiled between 1160 and 1170 contains various references to the distillation of rosewater by means of a *cucurbita* and a *vas duplex* (= *bain-marie*), but no reference whatever to *aqua ardens*. SUDHOFF had concluded that alcohol was not known in Salerno until the second half of xiith century. LIPPMANN concludes that it is the distillation of rosewater which suggested that of fermented beverages.

G. S.

Pardi, G. L'Italia nel XII secolo descritta da un geografo arabo (Memorie geografiche di GIOTTO DAINELLI, suppl. alla *Rivista geografica italiana*, n. 38), p. 59-171. Firenze, 1919. 1818

EDRISI's description of Italy, arranged state by state.

G. S.

Rohner, A. Das Schöpfungsproblem bei MOSES MAIMONIDES, ALBERTUS, MAGNUS und THOMAS von Aquin. (*Beiträge zur Geschichte der Philosophie des Mittelalters*, XI, 5), XII + 140 p. Münster i. W., 1913. 1818

Schneider, Artur. Die abendländische Spekulation des 12. Jahrhunderts in ihrem Verhältnis zur aristotelischen und jüdisch-arabischen Philosophie. (*Beitr. zur Gesch. d. Phil. d. Mittelalters*, XVII, 4), VIII + 76 p. Münster i. W. 1915. 1818

Smith, D. E. and Ginsburg, J. Rabbi BEN EZRA and the Hindu-Arabic Problem, *American mathematical monthly*, XXV, p. 99-108, 1918. 1818

English translation of ABRAHAM IBN EZRA's introduction to his own Hebrew translation of AL-BIRUNI's work on AL-KHOWARIZMI's tables. This gives interesting early views about the introduction among the Arabs of Hindu science.
L. C. K.

S. XIII

Albertus Magnus. De Animalibus libri XXVI nach der Cölner Ur-schrift, hrg. von HERMANN STADLER. 2 vol. (*Beitr. zur Gesch. d. Philos. d. Mittelalters*, Bd. 15 u. 16). Münster i. W. 1916-1920. 1818

Asin Palacios, Miguel. La escatologia musulmana en la Divina Come-dia, 403 p. Madrid, E. MAESTRE, 1919. 1818

[**Bacon, Roger**] Opera hactenus inedita ROGERI BACONI. Fasc. V. Secre-tum secretorum, cum glossis et notulis. Tractatus brevis et utilis ad declarandum quedam obscure dicta fratris Rogeri. Nunc pri-mum edidit ROBERT STEELE. Accedunt versio anglicana ex arabico edita per A. S. FULTON, versio vetusta anglo-normanica nunc primum edita, LXIV + 318 p. Oxford, CLARENDON Press, 1920. 1818

Baur, Ludwig. Die Philosophie des ROBERT GROSSETESTE, Bishofs von Lincoln († 1253). (*Beitr. zur Gesch. d. Mittelalters*, xviii, p. 4-6), xvi + 298 p. Münster i. W. 1917. 1818

Bridges, John Henry [1832-1906]. The life and work of ROGER BACON, with additions and notes by H. GORDON JONES, 173 p. London, WILLIAMS and NORGATE, 1914. 1818

Amplified ed. of BRIDGES' introduction to the OPUS MAJUS, 1897.

Cordier, Henri. Ser MARCO POLO. Notes and addenda to Sir HENRY YULE's edition, containing the results of recent research and discovery, x + 161 p. New York, SCRIBNER, 1920. [4 \$] 1818

In 1903, HENRI CORDIER edited the third edition of Sir HENRY YULE's (1820-1889) monumental translation of the Book of Ser MARCO POLO. He now offers us as a supplement to this edition, all the notes he has indefatigably collected on the subject within the last seventeen years. For ex., he has taken full advantage of the new knowledge obtained by Sir AUREL STEIN, SVEN HEDIN, PELLIOU, KOZLOV in their expeditions, and his own studies — especially his second ed. of YULE's *Cathay and the Way Thither* — have enabled him to gather all the information which was worth gathering, and even more. For this learned volume has unfortunately the defects of its qualities : supercommentaries are likely to be excessive ; all of CORDIER's notes are not equally relevant and important and they take us further and further away from the delightful memoirs which they are supposed to illus-trate.
G. S.

Dantis Alagherii Epistolae. The letters of DANTE. Emended text with introduction, translation, notes and appendix on the cursus by PAGET TOYNBEE, LVI + 305 p. Oxford, CLARENDON Press, 1920. 1818

Critical edition without the diplomatic transcriptions already published by the author in the *Modern Language Review*, 1912 to 1919. The intro-duction deals with the history of the letters from the xvth century to the present day. This edition contains the text of ten letters, 1304 to c. 1319.

The spurious letter to GUIDO da Polenta, 1314 is given in Appendix A — Appendix B is a chronological table from DANTE'S Priorate (1300) to his death (1321): *De vulgari eloquentia* probably written in 1304; *Convivio* probably finished by Nov. 1308; *Inferno*, *Purgatorio* and ten *cantos* of the *Paradiso* completed in 1319; *De aqua et terra*, Jan. 20, 1320; Sept. 14, 1321, death at Ravenna. — Excellent indexes. G. S.

Dreyer, J. L. E. On the original form of the Alfonsine Tables. *Monthly notices of the R. astron. soc.*, vol. 80, p. 243-262, 1920. 1818

The tables in their original form have never been printed and have been quite forgotten, but they are shown to exist in a number of MSS. in this country. The tables of mean motions are printed in this paper.

J. L. E. D.

Grabmann, Martin [1875-] *Forschungen über die lateinischen Aristoteles-Uebersetzungen des XIII Jahrhunderts.* (*Beitr. zur Gesch. d. Philos. d. Mittelalters*, xvii, 5-6), xxvii + 270 p. Münster i. W. 1916. 1818

Henricus Dacus (= HENRIK HARPESTRENG, d. 1244). *De simplicibus medicinis laxativis.* Udgivet for første gang af J. W. S. JOHNSON, 98 p. København, VILHELM PRIORS Kgl. Hofboghandel, 1914. 1818

First edition of the Copenhagen MS. G. K. S. 1654, 4° attributed to HENRICUS DACUS, whom the learned editor was able to identify with HARPESTRENG. The text of the *de simplicibus* is followed by a copious commentary (in Danish), p. 49-95, and by a bibliography. Two pages of the MS. are reproduced in fac-simile. See *Isis*, IV, 13. G. S.

Wicksteed, Philip Henry [1844-]. The reactions between dogma and philosophy. Illustrated from the works of St. THOMAS AQUINAS, xxvi + 670 p. London, WILLIAMS and NORGATE, 1920. 1818

Wiedemann, Eilhard. Ueber ein arabisches, eigentümliches Wasserrad und eine Kolhenwasserhaltige Höhle auf Majorka nach AL QAZWINI. *Mitt. zur Gesch. d. Medizin*, t. 15, p. 368-370. Leipzig, 1916. 1818

S. XIV

Diels, H. Über die Schrift Antipocras des NIKOLAUS von Polen. *Sitzungsber. d. Kgl. preuss. Akad. d. Wiss.* p. 376-394. Berlin, 1916. 1818

To complete what I have said in *Isis* III, 327. This text by the Dominican friar who was teaching in Montpellier in the beginning of the xvth century, is here completely re-published by DIELS (p. 379-394, 427 verses with a short preface in prose): "Incipit Antipocras, quem composuit et similiter noneupavit frater NICHOLAUS fratrum predicatorum. Alio autem nomine appellatur liber empiricorum". G. S.

Emerton, Ephraim. The Defensor Pacis of MARSIGLIO of Padua [d. 1342] A critical study. 81 p. Cambridge, Mass. HARVARD University Press, 1920. 1818

Favaro, Antonio. PIETRO d'Abano ed il suo « Lucidator astrologiae ». *Atti del R. Istituto Veneto*, t. 75, p. 2 da, p. 515-527. Venezia, 1916.

The *Lucidator* dates of 1310, that is, PIETRO wrote it later than his *Conciliator* (1303), towards the end of his life which occurred in 1315. He was professor of medicine, philosophy and astrology at the University of Padova. FAVARO discusses DUHEM's judgment of PIETRO in his *Système du Monde*, vol. IV. G. S.

Hamd-Allāh, Mustaufī al Kazwinī The geographical part of the *Nuzhat al-qulūb* composed by [him] in 740 (1340). Vol. II. English translation with notes. by GUY LE STRANGE, Leyden, BRILL, 1919. 1818

Vol. I containing the Arabic text appeared in 1915, see *Isis*, III, p. 99. G. S.

Huizinga, J. Herfsttij der Middeleeuwen. Studie over levens- en gedachtenvormen der veertiende en vijftiende eeuw in Frankrijk en de Nederlanden, XII + 568 p. Haarlem, H. D. TJEENK WILLINK en Zoon, 1919. 1818

Studies of life, thought, sensibility at the end of the Middle Ages (xivth and xvth centuries) in France and the Low Countries. The author's aim has been to speak of this period not as the beginning of the Renaissance but as the end — the autumn — of the Middle Ages; that is, to lay stress not so much upon the novelties as upon the declining traditions of this age. G. S.

Krazer, Adolf. Zur Geschichte der graphischen Darstellung von Funktionen. *Jahresbericht der deutschen Mathematiker-Vereinigung*, t. 24, p. 340-363. Leipzig, 1915 [1916]. 1818

About 1350, ORESME has borrowed from scholastic philosophy and consciously developed the idea of representing a function graphically. — His name stands alone, for neither his contemporary SUISET, nor (a little later) BIAGIO PELACANI have improved his original idea. The work of ORESME exerted no influence and when DESCARTES discovered analytical geometry 250 years later, he was inspired by Greek geometers, not by medieval philosophers. — See additional note by H. WIELEITNER, *Ibidem*, t. 25, p. 66, 1916. G. S.

Manning, Bernard Lord. The people's faith in the time of WYCLIF, xvi + 196 p. Cambridge University Press, 1919. 1818

Martin, Alfred von. COLUCCIO SALUTATI [1330-1406] und das humanistische Lebensideal. Ein Kapitel aus der Genesis der Renaissance. (*Beitr. zur Kulturgeschichte des Mittelalters u. d. Renaiss.*, 23). ix + 299 p. Leipzig, TEUBNER, 1916. 1818

Terry, Schuyler Baldwin [1833-]. The financing of the hundred years war, 1337-1360 (*Monographs of the London school of economics*), xx + 197 p. London, CONSTABLE, 1914. 1818

Würsdorfer, Joseph. Erkennen und Wissen nach GREGOR von Rimini, [d. 1358] Ein Beitrag zur Geschichte der Erkenntnistheorie des Nominalismus (*Beitr. z. Gesch. d. Mittelalters*, XX, 1), viii + 138 p. Münster i. W., 1917. 1818

S. XV

- [**Carbonelli, Giovanni**, 1854-]. *Bibliographia Medica Typographica Pedemontana saeculorum xv et xvi. a IOHANNE CARBONELLI medico doctore collecta. In qua non tantum auctorum nomina sed etiam fere omnium eorum operum inscriptiones eadem forma mensuraque relatae inveniuntur. Cum appendicibus et explanationibus atque indicibus copiosissimis*, [436 p. in-f^o]. Romae, Excudebat Fieramosca Centenari, MCMXIV. 1815

Admirable publication, sufficiently described by its title, containing a great many fac-simile reproductions of titlepages etc. It appeared only in 1909, the printing having been protracted since 1914. Only 200 copies have been published. G. S.

- Cohn, Berthold** [1870-]. *Der Almanach Perpetuum des ABRAHAM ZACUTO. Ein Beitrag zur Geschichte der Astronomie im Mittelalter. (Schriften der wissensch. Ges. in Strassburg, 32)*, 48 S. Strassburg, TRÜBNER, 1918. 1815

ABRAHAM SACUT or ZACUTO is one of the last medieval astronomers who wrote in Hebrew. His *Almanach Perpetuum*, Leira, Portugal 1496 (see below under ZACUTO) is claimed by BENSARD to be his masterpiece. Yet COHN believes, with STEINSCHNEIDER, that ZACUTO wrote only one work, his *Great Code* (1473-1478) in Hebrew, of which 3 MSS. copies exist (Lyon, Munich, Vienna): there is also an Arabic transl. in Milano — COHN gives extracts of the Hebrew text (Munich MS.) with translation. G. S.

- Ferrand, Gabriel**. A propos d'une carte javanaise du xv^e siècle. *Journal Asiatique*, t. XII, p. 158-169. Paris, 1918. 1818

Il s'agit de la carte mentionnée dans une lettre d'ALFONSE D'ALBUQUERQUE au roi de Portugal, 1^{er} avril 1512. Le Brésil était inscrit sur cette carte javanaise. G. S.

- Hartmann, J.** Die astronomischen Instrumente des Kardinals NIKOLAUS CUSANUS *Abhandl. d. Kgl. Gesel. d. Wissensch. zu Göttingen, mathem.-physik. Klasse*. Bd. X, 56 p., 12 pl. Berlin, 1919. 1818

A fundamental study of the astronomical instruments used by CUSANUS and still kept in the hospital founded by him in his native city Cues on the Moselle. They are the more interesting that they are the oldest German astronomical instruments in existence. The author has made use of CUSANUS' library (also kept in Cues), to understand better his instruments. An introduction contains the upshot of his investigations, then follow two chapters respectively devoted to CUSANUS' *torquetum* (dating of about 1434) and to his celestial globe, both of which are very well illustrated. WILHELM OSTWALD has added an appendix dealing with a microscopic study of the painting of the globe. G. S.

- Hartmann, J.** Die ältesten deutschen astronomischen Instrumente. *Zeitschrift für Instrumentenkunde*, 40, p. 221-235, 7 Fig., Berlin, 1920. 1818

A further study of CUSANUS' *torquetum* and astrolabe and of his wooden and copper celestial globes, with interesting information on the making of scientific instruments in Nürnberg. Important. G. S.

- Panofsky, Erwin**. DÜRERS Kunsttheorie vornehmlich in ihrem Verhältnis zur Kunsttheorie der Italiener, 210 p. Berlin, REIMER, 1915. 1818

Schuritz, Hans. Die Perspective in der Kunst DÜRERS. Ein Beitrag zur Geschichte der Perspective (*Diss.*, Darmstadt), 50 S., 22 T., Frankfurt, 1919. 1818

Vignaud, Henry. The Columbian tradition on the discovery of America and of the part played therein by the astronomer TOSCANELLI. A memoir addressed to HERMANN WAGNER of Göttingen and CARLO ERRERA of Bologna, 62 p. Oxford, CLARENDON Press, 1920. 1818

There is also a French edition published by the "Société des Américanistes" of Paris (not seen). G. S.

Wieleitner, H. Zur Erfindung der verschiedenen Distanzkonstruktionen in der malerischen Perspektive. *Repertorium für Kunstwissenschaft*, XLII, p. 249-262. Berlin, 1920. 1818

"BRUNELLESCHI hatte wahrscheinlich überhaupt keine Distanzkonstruktion irgendwelcher Art. Im Jahre 1435 oder etwas früher erfand ALBERT die *costruzione legittima*. Das Grund- und Aufrissverfahren wurde im Laufe des 15. Jahrhunderts in Italien ausgebildet und von PIERO DE' FRANCESCHI (um 1480) gelehrt. Von der eigentlichen Distanzpunkt konstruktion finden sich nur unklare Spuren im Quattrocento. Hingegen muss diese in der französischen Gotik zur selben Zeit im Schwang gewesen sein, da sie von VIATOR im Jahre 1505 mit voller Sicherheit angewendet wird. In Italien lehrte sie erst, als eine fast neue Methode, VIGNOLA, um 1530". G. S.

Zacuto, Abraham [born Salamanca c. 1450 — d. in Turkey, c. 1510]. Almanach Perpetuum Celestium Motuum (Radix 1473). Tabulae astronomicae Raby ABRAHAM ZACUTI, Astronomi JOHANNIS secundi et EMANUELIS serenissimorum regum Portugallae in latinum translatae per Magistrum JOSEPH VIZINUM discipulum autoris. Reproduction fac-similé de l'exemplaire appartenant à la bibliothèque d'Augsbourg. Édition 1496, Leira. (*Histoire de la science nautique portugaise...*, documents publiés par JOAQUIM BENSAUDE, vol. 3), 335 pl. Munich, OBERNETTER, 1915. 1818

Sur ZACUTO, voir ci-dessus COHN, BERTHOLD, Voir aussi *Isis*, III, p. 425. G. S.

Beltrami, Luca. La edizione nazionale vinciana e l'istituto CERMENATI, 1902-1920, xi + 83 p. Milano, ALLEGRETTI, 1920. [8 Lire.] 1818

History of the efforts made in Italy since 1902 to produce a national edition of LEONARDO's writings. Sharp but well deserved criticism of the CERMENATI Institute and of its first publication, the *Miscellanea* published in 1919 (see *Isis*, IV, p. 48). BELTRAMI's paper would be more effective if it were less prolix and written in a quieter mood. G. S.

Beltrami, Luca. LEONARDO, CECILIA e la « Destra Mano ». A proposito di una nota vinciana del prof. ANTONIO FAVARO, 15 p., Milano, ALLEGRETTI, 1920. 1818

FAVARO's note referred to was published in MIELI's *Archivio*, t. I, p. 403. G. S.

Bilancioni, Guglielmo. La fonetica biologica di LEONARDO DA VINCI. Estr. dal *Giornale di medicina militare*, fasc. XI, 26 p., 7 fig. Roma, 1919. 1818

Bilancioni, Guglielmo. La gerarchia degli organi dei sensi nel pensiero di LEONARDO DA VINCI. Estr. dal *Giornale di medicina militare*, fase XI, 30 p., 3 fig. Roma, 1919. 1818

Bilancioni, Guglielmo. L'orecchio e il naso nel sistema antropometrico di LEONARDO DA VINCI (Studi di storia della scienza, n. 1). 105 p., 31 fig. Roma, Nardecchia, 1920. 1818

Artistic anatomy and anthropometry of nose and ear with special reference to LEONARDO. Large amount of information artificially collected around a topic too small to support it. To choose a very special topic and then to speak of everything apropos of it is not a commendable method. There is a long bibliography, but open to the same criticism: it is out of focus.

G. S.

De Toni, G. B. Una ricetta medica nel Codice Atlantico [f° 270 b verso] di LEONARDO DA VINCI. *Giornale di medicina militare*, fasc. XI, 5 p. Roma, 1919. 1818

De Toni, Giovanni Battista. MARIO CERMENATI per LEONARDO. Ricordi ed appunti, 53 p. Roma, Industria tipografica romana, 1920. 1818

Eulogy of MARIO CERMENATI with special reference to his LEONARDO activities. CERMENATI is the founder and head of the Istituto di studi vinciani, in Rome apropos of which, see *Isis* IV, 48.

G. S.

[**Leonardo da Vinci**] Per LEONARDO DA VINCI nel IV Centenario dalla sua morte. *Giornale di medicina militare*, anno 67, fasc. XI, p. 1189-1281. Roma, 1919. 1818

ARNALDO ANGELUCCI. « La maniera in pittura e le leggi ottiche di luci e colori scoperti da L ». — GUGL. BILANCIONI. « La fonetica biologica di L ». — Id. « La Gerarchia degli organi dei sensi nel pensiero di L ». — ANTONINO ANILE. « L'anatomia di L ». — H. HOPSTOCK. « L. e i manoscritti anatomici-fisiologici di Windsor ».

G. S.

[**Mieli, Aldo.**] Studi e note vinciane: Reale commissione vinciana. Istituto vinciano di Roma. *Archivio di storia della scienza*, II, p. 108-116. Roma, 1921. 1818

About the gigantic plans made by the two Italian organizations devoted to LEONARDO.

G. S.

S. XVI

Alexander, Philip Frederick (editor). The northwest and northeast passage, 1576-1611, xx + 211 p., illustr. (Cambridge travel books), Cambridge University Press, 1915. 1818

Almagià, Roberto. Il primo tentativo di misura del rapporto quantitativo fra le terre emerse e i mari. *Archivio di storia della scienza*, II, p. 51-64. Roma, 1921. 1818

The first attempt to measure the ratio of the areas of land and sea was made by the Sienese humanist ALESSANDRO PICCOLOMINI (1508-1578) in his *Trattato della grandezza dell'acqua e della terra*, 1557. This was a poor attempt, for PICCOLOMINI concluded that taking the whole surface of the earth into account, the emerged parts were more extensive than the immersed ones, though not very much. However this was a distinct progress towards the truth if one remembers that according to the medieval notions, the emerged parts were seven times more extensive than the seas. Besides it was the first attempt to solve this problem quantitatively.

G. S.

Autin, Albert. L'échec de la Réforme en France au XVI^e siècle, VII + 286 p., Paris, COLIN, 1918. 1818

Bay, J. Christian. CONRAD GESNER (1516-1565). The father of bibliography. An appreciation. *The Papers of the Bibliographical Society of America*, vol. 10, p. 53-88, portrait and illustr. Chicago, 1916. 1818

Bensaude, Joaquim (editor). Regimento do estrolabio e do quadrante. Tractade da spera do mundo. Reproduction facsimilé du seul exemplaire connu appartenant à la Bibliothèque Royale de Munich. (*Histoire de la science nautique portugaise à l'époque des grandes découvertes*, vol. I), 31 p. + 64 pl. Munich, CARL KUHN, 1914. 1818

Ce *Regimento* est le plus ancien connu; il est antérieur à celui d'Evora qui lui-même fut publié avant 1521, peut-être même avant 1518. Le livre de Munich fut probablement publié après 1509, certainement après 1504. Il contient : (1) calcul des latitudes d'après la hauteur du soleil; (2) règlement de l'étoile polaire; (3) liste des latitudes des points découverts; (4) règlement pour évaluer le chemin parcouru par le navire; (5) calendrier et tables nautiques pour une année bissextile. Ce volume a paru en même temps avec une introduction en allemand dans la collection : « *Seltenheiten aus Süddeutschen Bibliotheken* », n° 5. G. S.

Bodin, Jean [1520-1596]. Le Colloque des secrets cachez des choses sublimes entre sept scavants qui sont de différens sentiments. Traduction française par ROGER CHAUVIRÉ, 212 p. Paris, CHAMPION, 1914. 1818

Boehm, Erich (editor). WILLIAM GILBERT begründet die Lehre vom Erdmagnetismus. 1600. (*Voigtländers Quellenbücher*, 84), 69 S., 14 Abb. Leipzig, 1914 (?). 1818

Bosmans, H. La « Thiende » de SIMON STEVIN. A propos d'un exemplaire de l'édition originale qui a échappé à l'incendie de la bibliothèque de l'université de Louvain. *Revue des questions scientifiques*, 35 p. Bruxelles, 1920. 1818

Longue analyse du très rare opuscule (36 p.) publié en flamand à Leyden en 1585 : *De Thiende*. STEVIN en fit une traduction française (*La Disme*), qu'il publia la même année en annexe à son *Arithmétique*, chez le même éditeur CHR. PLANTYN. *La Disme* est le plus ancien manuel contenant un exposé complet et rigoureux des opérations fondamentales relatives aux fractions décimales; STEVIN y défend l'emploi systématique non seulement des fractions décimales, mais aussi d'une métrologie décimale. G. S.

Bosmans, H. Quel fut l'auteur du « *De quadrante geometrico libellus* » édité à Nuremberg en 1594 aux frais de CORNEILLE DE JODE? *Revue des questions scientifiques*, 13 p. Bruxelles, 1920. 1818

L'auteur du texte de cet admirable livre d'images est le Gantois LIÉVIN HULSIUS qui mourut à Francfort en 1606. C'était un libraire-éditeur doublé d'un marchand d'appareils scientifiques et son *De quadrante geometrico* était peut-être écrit en partie pour allécher le lecteur et le déterminer à acheter l'instrument en question. Aux cinq exemplaires de cet opuscule rarissime mentionnés par le R. P. BOSMANS, il faut en ajouter au moins un 6^e, celui de l'Université HARVARD. G. S.

- Bosmans, H.** L'œuvre scientifique de MATHIEU RICCI, S. I. [Macerata, 6 oct. 1552 — Péking, 11 mai 1610]. *Revue des questions scientifiques*, 16 p., janvier 1921. 1818

Une étude des travaux de géographie et de mathématique du plus grand missionnaire que la Compagnie de Jésus ait envoyé en Chine, à propos de la publication de ses Mémoires et de sa Correspondance, par les soins du P. TACCHI VENTURI, 2 vol., gr. in 4°. Macerata 1911-1913. G. S.

- Butler, Sir Geoffrey** [1887-]. *Studies in Statecraft*. Being chapters biographical and bibliographical mainly on the sixteenth century, vii + 138 p. Cambridge University Press, 1920. 1818

- Callender, Geoffrey.** Was DRAKE guilty of murder? *Discovery*, t. I, p. 293-300. London, 1920. 1818

The author's conclusion is that DRAKE should be absolved. Bibliography (see below NUTTALL). G. S.

- Charbonnel, J. R.** La pensée italienne au XVI^e siècle et le courant libér-tin, ix + 720 + LXXXIV p. Paris, CHAMPION, 1919. 1818

- Chauviré, Roger.** JEAN BODIN, auteur de la République, 543 p. Paris, CHAMPION, 1914, 1818

- Choate, Helen A.** The earliest glossary of botanical terms: FUCHS 1542. *Torreya*, vol. 17, p. 186-201, 1917. 1818

Miss CHOATE has compared this glossary with a modern one (JACKSON, 1900). Of the 127 terms (exclusive of synonyms) used by FUCHS, 83 or 66 per cent., are still in use with identical or closely related meaning, 22 are in use but with changed meaning, 14 are obsolete, 7 are not botanical terms. The author examines each term separately. G. S.

- Crane, Thomas Frederick** [1844-]. Italian social customs of the xvth century. Their influence on the literature of Europe, xv + 690 p. New Haven, YALE University Press, 1920. 1818

- De Toni, Ettore** Appunti botanici del codice-erbario di PIETRO ANTONIO MICHEL [Venezia 1510-ibid. 1576]. *Archivio di storia della scienza*. t. I, p. 137-140. Roma, 1920. 1818

- Dreyer, J. L. E.** On TYCHO BRAHE's Manual of Trigonometry. *The Observatory*, vol. 39, p. 127-131, 1916. 1818

Shows that the method of *Prosthaphaeresis* was due to PAUL WITTICH and MELCHIOR JOBSTEL. J. L. E. D.

- Dreyer, J. L. E.** On TYCHO BRAHE's catalogue of stars. *The Observatory*, vol. 40, 229-233, 1917. 1818

How the star-places were found and catalogued. J. L. E. D.

- Dreyer, J. L. E.** The alleged new star of the year 1578. *The Observatory*, vol. 42, p. 161-162, 1919. 1818

There was no temporary star in that year, nor any comet after the Great Comet of Nov. 1577 to Jan. 1578. J. L. E. D.

- Dyroff, Adolph** [1866-]. Ueber FR. BACONS Vorläufer. (MOCENIGO). *Renaissance und Philosophie*, 13. H., p. 107-109. Bonn, 1916. 1818

The archbishop FILIPPO MOCENIGO of Nicosia, Cyprus, gave in 1581 (?) a theory of induction which is more elaborate than that of ARISTOTLE and of the schoolmen, and has already a modern accent. This short note is published as appendix to MATTH. UEDELHOFEN. *Die Logik PETRUS FONSECAS* [PEDRO DA FONSECA, 1528 Cortizada, Portugal — 1599 Lisbon]. G.S.

Faleiro, Francisco. Tratado del esfera y del arte del marear. Reproduction fac-similé de l'exemplaire appartenant à la bibliothèque royale de Munich. Edition 1535, Séville. 102 pl (*Histoire de la science nautique portugaise à l'époque des grandes découvertes*. Collection de documents publiés par JOAQUIM BENSANDE, vol. 4). Munich, OBERNETTER, 1915. 1818

Cet ouvrage qui était terminé en 1532 (date de l'approbation royale espagnole) est le premier traité de navigation imprimé dans la péninsule, si l'on ne compte pas comme tels les Règlements de l'astrolabe. Il contient plusieurs méthodes pour mesurer la déviation magnétique et marque un très grand progrès sur les Règlements (voir plus haut, BENSANDE). FRANCISCO était le frère de RUY FALEIRO collaborateur de MAGALHÃES; c'était un Portugais au service de l'Espagne. G. S.

Heckmanns, Joseph. Die Aeusserungen des DESIDERIUS ERASMUS von Rotterdam zur Tierpsychologie. *Renaissance und Philosophie*, 13. H., p. 113-206. Bonn, 1916. 1818

Hellmann, G. Die älteste gedruckte Nordlichtbeschreibung. *Beitr. zur Gesch. d. Meteorologie*, Nr. 3, p. 107-113. Berlin, 1914. 1818

The first printed descriptions of *aurora borealis* occur in 1527. HELLMANN gives an account of various publications (three title-pages are reproduced) describing the *aurora* of Oct. 11, 1527, but under the name of comet. The earliest good description of a northern light is found in a Norse MS. of the XIIIth century, and it is called northern light (nordurljós). This name however, does not seem to have been printed before 1716. G. S.

Lucas, Frederic A. The unicorn and his horn. *Natural History*, vol. XX, p. 532-535. New York, 1920. 1818

Contains, mixed with older material, an illustrated description of the horn of Indian Rhinoceros known as alicorne or unicorn which was presented to Pope GREGORY XIV, in 1590, because of its reputed medicinal qualities. The tip of this historical horn is missing, for it was reduced to powder and administered to the Pope in his last illness. This horn was purchased by Dr L. POLLAK of Rome at the FERRONI sale of 1909, from whom it was obtained by Mr. JOHN MARSHALL who presented it to the American Museum of Natural History of New York in 1920. G. S.

Mestwerdt, Paul [1888-1914]. Die Anfänge des ERASMUS. Humanismus und « Devotio moderna ». Mit einer Lebensskizze von C. H. BECKER, hrg. v. HANS VON SCHUBERT (*Studien zur Kultur und Gesch. d. Reformation*, 2), XXI + 343 p., Bildniss. Leipzig, HAUPT, 1917. 1818

Murray, Robert Henry [1874-]. ERASMUS and LUTHER. Their attitude to toleration, XXIII + 503 p., London. Society for promoting Christian Knowledge, 1920. 1818

Nunez, Pedro [or NONIUS, b. Alcaçar do Sal 1492 — d. 1577 or 1578]. Tratado da sphaera com a theorica do sol e da lua e ho primeiro livro da geographia de CLAUDIO PTOLOMEU. Tirados novamente de latim em linguagem pello doutor PERO NUNEZ. Tratado que ho

doutor PERO NUNEZ fez em defensam da carta de marear. Tratado que ho doutor PERO NUNEZ fez sobre certas duvidas da navegacao. Reproduction fac-similé de l'exemplaire appartenant à la bibliothèque du duc de Brunswick à Wolfenbüttel. Édition 1537, Lisbonne (*Histoire de la science nautique portugaise*, ..., documents publiés par J. BENSAUDE, 5), 180 p. in-fol., Munich, OBENRETTETTER, 1915.

1818

Cet ouvrage est très important parce que NUNEZ y insiste sur l'urgente nécessité de donner des bases rigoureuses à la cartographie, et de faire des observations scientifiques sur la déviation magnétique. Il n'y parle pas du calcul des longitudes. Cette œuvre prépare celle de MERCATOR. — Cette reproduction fac-similé, comme les autres parues dans la même collection (voir S. XV, ZACUTO; S. XVI, BENSAUDE; FALCÃO) est splendide : elle fait honneur à la république portugaise.

G. S.

Nuttall, Zelia. New light on DRAKE. A collection of documents relating to his voyage of circumnavigation, 1577-1580 Translated and edited, LVI + 443 p., 17 plates and maps. London, HAKLUYT Society (2nd series, no. 34), 1914.

1818

A collection of 65 hitherto unpublished Spanish documents, discovered by the author in the archives of Mexico, Spain and other countries; edited, translated and fully annotated with reference to many other MSS. This volume completes DRAKE's *World Encompassed* edited by W. S. W. VAUX, HAKLUYT Society, 1854. It is a very important contribution to our knowledge of Sir Francis DRAKE.

G. S.

Ortroy, Fernand van. L'œuvre cartographique de GÉRARD et de CORNEILLE DE JODE, XXXV + 130 p., 5 pl., 1 portrait (de GÉRARD). Gand, VAN GOETHEM, 1914.

1818

GÉRARD DE JODE, naquit à Nimègue en 1509, mourut à Anvers le 5 février 1591; CORNEILLE, son fils, mourut en 1600 dans sa 32^e année. Ils n'étaient pas juifs quoiqu'ils fussent appelés DE JODE = DE IYDAEIS.

G. S.

Peters, Hermann. LUTHERS Stellung zur Chemie. *Chemiker Z. S.* 729, 1917.

1818

Sadoletto, Iacopo. [Modena 1477 — Roma 1547]. On Education. A translation of the « de pueris recte instituendis » with notes and introduction by ERNEST TRAFFORD CAMPAGNAC and K. FORBES, XLVIII + 141 p. London, MILFORD, 1916.

1818

Schuller, Rudolf. The ORDÁZ and DORTAL expeditions in search of El-Dorado as described on sixteenth century maps. Smithsonian miscellaneous collections, vol. 66, no. 4. Washington, 1916.

1818

Reproduces and discusses OYIBO's Huyapari map which the author believes was only drawn after 1542 (and not in 1532 as HARRISSE said) and the Spanish anonymous map of about 1560.

G. S.

Smith, David Eugene. The first work on mathematics printed in the new world. *The American mathematical monthly*, t. XXVIII, p. 10-14, 1921.

1818

This is the *Sumario Compendioso* published in Mexico City 1556. A fac-simile reprint of the original work will presently be published by GINN, Boston, with translation and notes by Prof. SMITH.

G. S.

- Smith, Vincent Arthur.** AKBAR, the great Mogol, 1542-1605 Oxford, CLARENDON Press, 1917. Second ed. revised, xvi + 504 p., 1919, (or 1920?, not seen). 1818

- Stillman, John Maxson.** THEOPHRASTUS BOMBASTUS VON HOHENHEIM called PARACELSUS. His personality and influence as physician, chemist and reformer, viii + 184 p. Chicago, Open Court, 1920. 1818

A new general study based upon recent research (SUDHOFF etc.) and for the text upon the Strassburg folio ed. of 1616, the Chirurgische Bücher und Schriften, *ibid.* 1618 and the extracts from Paracelsus MSS. contained in SUDHOFF's fundamental bibliography, 1894-1899. G. S.

- Sudhoff, Karl.** ANDREAS VESALIUS zu Ehren, zum vierhundertjährigen Gedächtnis seiner Geburt gesprochen. 29 S., 18 Fig. [1914? 1915? sine loco et anno]. 1818

- Vignaud, Henry.** AMÉRIC VESPUCE, 1451-1512. Sa bibliographie, sa vie, ses voyages, ses découvertes, l'attribution de son nom à l'Amérique, ses relations authentiques et contestées, ix + 421 p. (*Recueil de voyages et de documents pour servir à l'histoire de la géographie depuis le XIII^e jusqu'à la fin du XVI^e siècle*, 23). Paris, LEROUX, 1917. 1818

S. XVII

- Bacchini, Amato.** La vita e le opere di GIOV. MARIA LANCISI [Roma 1654-1720] 115 p., ritr., 7 tav., 10 ill. Roma, SANSAINI, 1920. 1818

- Bosmans, H.** La notice nécrologique de FERDINAND VERBIEST par son secrétaire ANTOINE THOMAS de Namur, vice-président effectif et président intérimaire de l'Observatoire de Péking. *Annales de la Société d'Emulation*, p. 102-133. Bruges, 1914. 1818

A reprint of Father VERBIEST's *Elogium*, that is, the circular letter announcing his death and describing his life, which was sent according to custom, to his Jesuit brothers. This *Elogium* was printed in 1688, soon after VERBIEST's funerals; it is likely that only very few copies, say 20, were printed, but translations in Spanish and German were published in 1691 and 1728. Father BOSMANS' paper contains an introduction (14 p.) then the text: *Elogium Reverendi Patris FERDINANDI VERBIEST*. A plate reproduces VERBIEST's epitaph in Latin and Chinese. Many footnotes elucidate the text. G. S.

- Bosmans, H.** A propos d'un exemplaire de la première édition de la RABDOLOGIE de NEPER qui a échappé à l'incendie de la bibliothèque de l'université de Louvain. *Annales de la Société scientifique de Bruxelles*, session du 27 novembre 1919, 1^{re} section. 1818

Complete description of the first edition of the *Rabdologiae seu numerationis per virgulas libri duo*. *Edinburgi* 1617, 154 p., 4 pl. in-12. The second and third editions appeared in Leyden 1626, 1628 and ADR. METIUS published a summary of it in his *Manuale arithmeticae et geometricae practicae*, Amsterdam 1634. G. S.

- Bulpit, W. T.** Misconceptions concerning JEREMIAH HORROCKS, the astronomer. *The Observatory*, vol. 37, p. 335-337, 1 pl., 1914. 1818

He was not ordained; he died at the age of 21, moreover there is no record of his ordination. J. L. E. D.

Campanella, Tommaso [b. in Calabria 1568-d. Paris 1639]. *La Città del Sole*. Testo critico, introduzione e note a cura di GIUSEPPE PALADINO, XXXI + 164 p. Napoli, GIANNINI, 1920. 1818

Cardini, Massimiliano. FRANCESCO REDI (Vite dei medici e naturalisti celebri, 2) 118 p., 8 pl. Firenze, 1914. 1818

Dietz, Johann [-Halle 1738] Meister JOHANN DIETZ des Grossen Kurfürsten Feldscher und Königlicher Hofbarbier. Nach der alten Handschrift in der Kgl. Bibl. zu Berlin zum ersten Male in Druck gegeben von Dr. ERNST CONSENTIUS (Schicksal und Abenteuer. Lebensdokumente vergangener Jahrhunderte. XI. Bd.), 368 S. LANGEWIESCHE-BRANDT. Ebenhausen bei München, 1915. 1818

Autobiography of a barber, that is a surgeon, at the end of the seventeenth century and the beginning of the eighteenth. The title quoted on p. 11, being more explicit than that of the book, is worth quoting : " Meister Johann Dietz. Das ist die getreue von ihm selbst gemachte Beschreibung seines Lebens, *item* alles dessen was er wider die Türken, am Nordpol, in deutschen Gauen und Gassen, unter Soldaten, Räubern und Bürgern, Jungfern und Gespenstern, endlich in seiner Vaterstadt Halle mit zweien Frauen erfahren und so aus dieser Welt insgesamt hat leiden müssen ". This book has obtained a very great success, as 35 thousand copies had already been printed in 1919. The editor has added an introduction, notes (p. 321-330), archival documents concerning the author, his family and the barber profession, and an index. G. S.

Doublet, E. Le tricentenaire de l'abbé PICARD. *Revue générale des sciences*, t. 31, p. 561-564. Paris, 1921.

JEAN PICARD né à La Flèche le 21 juillet 1620, mort vers 1683 (1682? 1684?), astronome, physicien. Courte biographie. G. S.

Doumic, René. Les fêtes de DESCARTES à Amsterdam. *Revue des Deux Mondes*, p. 151-156. Paris, nov. 1920. 1818

Favaro, Antonio. Quarant'anni di studi Galileiani (1876-1915). *Atti d. R. Istituto Veneto*, t. 74, p. 2^{da}, 1615-1658. Venezia, 1916. 1818

A bibliographical list of the Galilean writings of the indefatigable great old man, with a very useful subject index. The list contains 215 items, and it must be noted : (1) that it is not complete for FAVARO is still very active and has published many other Galilean papers since 1915; (2) that the twenty large volumes of the monumental edition of GALILEO's works (1890-1909) are but one item of the list (n° 61); (3) that FAVARO has written a very large number of papers on other subjects. G. S.

Favaro, Antonio, EVANGELISTA TORRICELLI e GIOVANNI CIAMPOLI. *Archivio di storia della scienza*, II, p. 46-50. Roma, 1921. 1818

Apropos of C. DE WAARD's contention (Un episodio della vita di T. sconosciuto ai suoi biografi, LORIA's *Bollet.*, II, 33-35, 1919) that T. acted as secretary to Mons^r GIOVANNI CIAMPOLI, while the latter was governor of Fabriano. FAVARO considers that this contention is non proven. G. S.

Favaro, Antonio. La casa di Arcetri nella quale spirò GALILEO « Monumento Nazionale ». *Archivio di Storia della Scienza*, I, p. 438-440. Roma, 1920. 1818

The house called « Gioielli » in Arcetri, a suburb of Florence, wherein GALILEO died at 4 A. M. on the 8th of January 1642, is now a national monument. Prof. ANTONIO ABETTI of the Astronomical observatory of Arcetri has been collecting for a long time GALILEO materials of all kinds. New physical institutes will soon be established in Arcetri which will become the scientific center of Florence and at the same the main center of information on GALILEO. G. S.

Hakovb Karnétsi. [JACOB d'Erzeroum]. Erzeroum ou la Topographie de la Haute Arménie. Texte arménien de HAKOVB KARNÉTSI (XVII^e siècle) publié par K. KOSTANEANTS (1903), traduit et annoté par FRÉDÉRIC MACLER (1917). *Journal Asiatique*, t. XIII, p. 153-237. Paris, 1919. 1818

Hellmann, G. Die Vorläufer der Societas Meteorologica Palatina. *Beitr. zur Geschichte der Meteorologie*, Nr. 5, p. 139-147. Berlin, 1914. 1818

Apropos of the endeavours to organize comparative meteorological observations in various places before the first successful and relatively large undertaking of this kind by the Societas Meteorologica Palatina of Mannheim in 1780. The earliest mentioned is that by the Landgrave HERMANN of Hessen (Uranophilus Cyriandrus) 1637; then, the earliest observations with instruments in Paris, Clermont-Ferrand and Stockholm 1649-1651; then the comparative observations organized since 1654, by the Grandduke of Toscana, FERDINAND II and his brother LEOPOLD, the founder of the Accademia del Cimento, etc. G. S.

Hellmann, G. Die ältesten instrumentellen meteorologischen Beobachtungen in Deutschland. *Beitr. zur Gesch. d. Meteorologie*, Nr. 2, S. 103-107; *Veröff. d. Kgl. Preuss. meteor. Inst.*, Nr. 273. Berlin, BEHREND, 1914. 1818

The oldest meteorological observations in Germany with the help of instruments were inspired by LEIBNIZ and took place in Hannover 1678 and Kiel 1679. HELLMANN publishes the facts concerning both cases. G. S.

Hellmann, G. Die erste meteorologische Instrumentenkunde. *Beitr. zur Geschichte der Meteorologie*, t. II, S. 334-339. Berlin, 1917. 1818

The first writing giving information on the meteorological instruments (thermo-, baro- and hygrometer) was due to SAMUEL REYHER, *de aere*, Kiel 1669. A larger work in 2 vol. was published in Nurnberg 1676-84, J. C. STURM's *Collegium Experimentale*. But the most successful book of this kind was DALENCE'S *Traitez des baromètres, thermomètres et notiomètres ou hygromètres*. Amsterdam 1688. HELLMAN describes 12 editions of this book published in 4 languages from 1688 to 1753. G. S.

Huygens, Christian. [La Haye 1629-La Haye 1695]. *Traité de la Lumière*. (Les maîtres de la pensée scientifique). x + 155 p. Paris, GAUTHIER-VILLARS, 1920. [3 fr. 60] 1818

Reproduction of the original text of this great treatise published in Leyden 1690, but of which HUYGENS had written the largest part as early as 1678 while he was dwelling in France. See the account of it which I gave (*Isis*, I, p. 273-274) apropos of SILVANUS THOMPSON's English translation, London 1912. G. S.

Huygens, Christiaan. Œuvres complètes publiées par la Société hollandaise des Sciences. La Haye, Nijhoff, t. I-XII, 1888-1910; t. XIII. Dioptrique, 1653-1692, 1916; t. XIV. Calcul des probabilités. Travaux de mathématiques pures, 1655-1666, 1920. 1818

Knobel, E. B. ON FREDERICK DE HOUTMAN'S Catalogue of Southern Stars and the origin of southern constellations. *Monthly notices of the R. astronomical society*, vol. 77, p. 414-432, 580, 1917. 1818

The catalogue published by HOUTMAN in 1603 and reproduced here and the formation of the 12 southern constellations are really due to PIETER DIRCKSZ KEYZER.
J. L. E. D.

Loria, Gino. NEWTON. (*Profili*, N. 52). 69 p., 1 portrait. Roma, FORMIGGINI, 1920. [L. 3] 1818

A well-informed and pleasantly written sketch followed by a good bibliography.
G. S.

Marius, Simon. The Mundus Jovialis, translated by A. O. PRICKARD from the original, Nürnberg 1614. *The Observatory*, vol. 39, p. 367-380, 403-412 (with plate), p. 443-451, 498-503, 1916. 1818

See also *Ibidem*, vol. 40, p. 119-122, 1917 a note by the translator on the question of priority as to the discovery of the four satellites of Jupiter.
J. L. E. D.

Mautz, Otto. Zur Basisbestimmung der Napierschen und Bürgischen Logarithmen. Beilage zu den Jahresber. des Gymnasiums, der Realschule u. der Töchterschule in Basel, 50 p., 1 pl. Basel, 1919. 1818

A very elaborate examination of the whole subject followed by criticisms of the treatment of same question by various authors (CANTOR, WEBER, WELLSTEIN, TROPFKE, FÄRBER, WITTSTEIN, KOPPE, BRAUNMÜHL, ROUSE BALL; BALL'S account is particularly bad).
G. S.

Mautz, Otto. Zur Stellung des Dezimalkommas in der Bürgischen Logarithmentafel. *Verhandl. der naturforsch. Gesellschaft in Basel*, Bd. 32, p. 104-106, 1921. 1818

An addition to MAUTZ's paper of 1919: "Die Byrgii Arithmetica" und der "gründliche Unterricht" lassen fast mit Sicherheit den Schluss aus, das das Bürgische Ringlein [*i.e.* a little circle placed above the numeral] die Rolle unseres Dezimalkommas spielt. Als Basis der Bürgischen Logarithmensystems muss somit $10\sqrt[10]{1,0001}$ angesehen werden...
G. S.

Meier, Matthias. DESCARTES und die Renaissance, XII + 68 p. Münster i. W., ASCHENDORFF, 1914. 1818

Morse, Katherine. MILTON'S ideas of science as shown in "Paradise lost". *Scientific Monthly*, v. 10, p. 150-156. New York, 1920. 1818

Mundy, Peter [b. Penryn in Cornwall, c. 1596-d. after 1667]. The Travels of PETER MUNDY in Europe and in Asia, 1608-1667. Edited by Lt. Col. Sir RICHARD CARNAC TEMPLE, Bart. 4 vol. London, Hakluyt Society, 1907-1919. 1818

Vol. I. Cambridge 1907 : Travels in Europe, 1608-1628, with an introduction of 51 p. Vol. II, 1914. Travels in Asia 1628-1634. Vol. III, part I, 1919. Travels in England, Western India, Achin, Macao and the Canton river, 1634-1637. Vol. III, part II, 1919. Travels in Achin, Mauritius, Madagascar and St Helena 1638.

Sorley, William Ritchie. [1855-]. SPINOZA. (Third annual lecture on a master mind) 20 p. For the British Academy. London, MILFORD, 1918.

Turnbull, G. H. SAMUEL HARTLIB. A sketch of his life and relations to J. A. COMENIUS. VIII + 79 p. London, MILFORD, 1920.

Vaughan, Thomas [1622-1666]. The works of THOMAS VAUGHAN, Edited, annotated and introduced by ARTHUR EDWARD WAITE, LI + 498 p. London, Theosophical publishing house, 1919.

An English poet and alchemist, whose alchemical writings were published under the pseudonym : EUGENIUS PHILALETHES. G. S.

Wieleitner, H. Zur Erfindung der analytischen Geometrie. Mathematisches Lesebuch hrg. v. W. DIECK, 13 p. Sterkrade, 1921.

Reprinted in slightly abbreviated form from *Z. f. math. u. naturw. Unterricht*, vol. 47, p. 414-426, 1916. Explains first DESCARTES' contribution, then that of FERMAT. G. S.

S. XVIII

Archibald, R. C. Time as a fourth dimension. *Bull. American mathematical soc.*, vol. 20, p. 409-412, 1914.

Was LAGRANGE the first to conceive time as a fourth dimension of space? In his *Théorie des fonctions analytiques* indeed he states that mechanics can be considered as a geometry of four dimensions, but does not elaborate this idea any further. D'ALEMBERT in the article "Dimension" published in his *Encyclopédie* 1754, says : " Un homme d'esprit de ma connaissance [LAGRANGE, then Ae. 18?] croit qu'on pourrait regarder la durée comme une quatrième dimension ... ". G. S.

Berkeley, George. [Dysert, Kilkenny county, Ireland 1685—Oxford 1753]. *La Siris*, publiée pour la première fois en 1744. Traduction française par GEORGES BEAULAVON et DOMINIQUE PARODI (*Les Classiques de la Philosophie*), VIII + 160 p. Paris, COLIN, 1920. [5 fr.]

French translation with biographical, bibliographical and critical notes of BERKELEY's treatise : *Siris*, a chain of philosophical reflexions and inquiries concerning the virtues of tar-water..., 1744, — which is generally known in French and other languages as " Tar-Water " (*L'eau de goudron*). Berkeley had brought back from Rhode Island where he lived from 1728 to 1732, a knowledge of the medical use of tar water and his *Siris* is an extraordinary philosophico-medical miscellany devoted to the propagation at one and the same time of his philosophical ideas and of this wonderful panacea. The translation has evidently been made with great care. G.S.

Berkeley, George. *Les Principes de la connaissance humaine.* Traduction de CHARLES RENOUVIER. (*Les Classiques de la Philosophie*, VIII). XII + 110 p. Paris, COLIN, 1920, [4 fr.]

Reprint of **RENOUVIER's** translation of **BERKELEY's** treatise concerning the principles of human knowledge, 1710, which first appeared in the *Critique Philosophique*, fifth year, 1889. The new editor **A. LALANDE** has made a few minor alterations to increase the accuracy of the translation. G. S.

Brown, P. Hume [1845-1918] *The Life of GOETHE*. With a prefatory note by Viscount **HALDANE**, 2 vol., illustr. London, **MURRAY**, 1920. 1818

Cajori, Florian. A history of the conceptions of limits and fluxions in Great Britain from **NEWTON** to **WOODHOUSE**, viii + 300 p. Chicago, Open Court, 1919. 1818

Choate, Helen A. An unpublished letter by **GRONOVIVS**. *Torreya*, vol. 16, p. 116-119, 1916. 1818

A letter from **JOHN. FRIED. GRONOVIVS** to **JOHN BARTRAM** dated Leyden, June 26, 1751; now kept in the botanical library of Smith College, Northampton, Mass. G. S.

Dreyer, J. L. E. Descriptive catalogue of a collection of **WILLIAM HERSCHEL** papers presented to the R. astronomical society by the late Sir **W. J. HERSCHEL**. *Monthly notices of the R. astronomical soc.*, vol. 78, p. 547-554, 1918. 1815

Fletcher, C. R. L. and Walker, Emery. *Historical Portraits, 1700-1850*. Introduction by **C. F. BELL**, 2 vol. Oxford, **CLARENDON** Press, 1919. 1818

Deals only with British portraits, each being reproduced by **EMERY WALKER**, the lives briefly told by **FLETCHER**. This collection includes the portraits of many scientists. G. S.

Fox, R. Hingston. *Dr JOHN FOTHERGILL and his friends*. Chapters in eighteenth century life, xxiv + 434 p. London, **MACMILLAN**, 1919. 1818

Freshfield, Douglas W. *The life of HORACE BÉNÉDICT DE SAUSSURE* [Geneva 1740-1799]. With the collaboration of **HENRY F. MONTAGNIER**, xii + 479 p. London, **E. ARNOLD**, 1920. 1818

Hellmann, G. *Die ältesten meteorologischen Symbole. Beitr. zur Gesch. d. Meteorol.*, t. II, p. 317-324. Berlin, 1917. 1818

Neglecting the mere abbreviations and the symbols used in calendars printed for illiterate peasants, the first symbols used with a scientific purpose and printed are found in **P. VAN MUSSENBROECK**. *Physicae experimentales et geometricae...*, Leyde 1729, — and a little later in an anonymous book by a meteorologist of Thuringia, Eisenberg, 1733. Then followed **LAMBERT**, 1758, 1771, **VON FELSINGER** 1773, the Norwegian pastor **J. N. WILSE** 1778, **J. L. BÖCKMANN** 1780, and the much improved system devised for the *Societas Meteorologica Palatina* by **HEMMER**, first published 1783, etc.

G. S.

Jovy, Ernest. *Quelques lettres de M. EMERY au physicien GEORGES LOUIS LE SAGE, conservées à la Bibliothèque de Genève*, 61 p. Paris, Société française d'imprimerie et de librairie, 1916. 1818

Lettres de l'abbé **EMERY** (m. 1811), théologien et supérieur de Saint-Sulpice pendant la révolution, à **LESAGE**, 1796 à 1800. L'abbé **EMERY** y parle

surtout de science et de philosophie; il y fait allusion à de MONTMOR, THOMAS BURNET, EULER, NEWTON, etc. G. S.

Kaye, G. R. A guide to the old observatories at Delhi, Jaipur, Ujjain, Benares. vii + 108 p., 15 pl. Calcutta, Government printing office, 1920. 1818

An abstract of the larger volume fully analyzed in *Isis* II, 421-423. G.S.

Kleineibst, Richard. G. CHR. LICHTENBERGS Stellung zur deutschen Literatur, vi + 60 p. Strassburg, Trübner, 1915. 1818

Lancisi, Giovanni Maria [1654-1720]. Per GIOVANNI MARIA LANCISI nel II centenario dalla sua morte. *Giornale di medicina militare*, anno 68, fasc. IX, p. 541-642, illustr. Roma. Sett. 1920. 1818

Contains discourses pronounced by ETTORE MARCHIAFAVA in Roma and MODESTINO DEL GAIZO in Naples, also the following : SILVESTRO BAGLIONI. Il metodo dello studio della medic. secondo LANCISI; GUGL. BILANCIONI. LANCISI e lo studio degli organi di senso; PIETRO CAPPARONI. Lancisiana (Documenti inediti : Atti di nascita e di morte, etc). G. S.

Lavoisier, Antoine-Laurent [Paris 1743-Paris 1793]. Mémoires sur la respiration et la transpiration des animaux (Les maîtres de la pensée scientifique), viii + 67 p. Paris, GAUTHIER-VILLARS, 1920. [3 fr.] 1818

Réimpression de quatre mémoires fondamentaux de LAVOISIER datés respectivement de 1777, 1785, 1789 et 1790, les deux derniers signés " SEGUIN et LAVOISIER ". G. S.

Loria, Gino. Per la storia del newtonianismo in Italia. *Atti della Soc. italiana del Progresso delle Scienze*, X Riunione, 7 p. Pisa, 1919. Roma, 1920. 1818

Reproduces two anonymous Italian poems dealing with Newtonian philosophy and alludes to a third one; all three of the xviiith century. This is of interest to the historian of thought rather than to the historian of science. G. S.

Macpherson, Hector. HERSCHEL 78 p. London, Society for promoting Christian Knowledge, 1919. 1818

Marguet, F. Histoire de la longitude en mer au xviii^e siècle en France x + 227 p. Paris, CHALLAMEL, 1917. 1818

Mourelle, Don Francisco Antonio [or MAURELLE]; born in San Adrián de Corme, Coruña, 1755; d. Cádiz, 1820], Voyage of the Sonora in the second Bucareli expedition to explore the north-west coast, survey the port of San Francisco and found Franciscan missions and a presidio and pueblo at that port. His journal kept in 1775 on the Sonora, translated by the Hon. DAINES BARRINGTON [1727-1800] ... with notes by THOMAS C. RUSSELL, a portrait of BARRINGTON and the DE LA BODEGA Carta General, 1791, xii + 120 p. in-4^o [only 230 copies]. San Francisco, Calif. THOMAS C. RUSSELL, 1734 Nineteenth Avenue, 1920. 1818

[**Priestley, Joseph**] The Northumberland home of JOSEPH PRIESTLEY, *Scientific monthly*, v. X, p. 522-524. New York, 1920. 1818

See *Isis*, III, 342. The present note contains additional information, two views of the house and a portrait of PRIESTLEY. G. S.

Ramsay, Sir William. The life and letters of JOSEPH BLACK, M. D. With an introduction dealing with the life and work of Sir WILLIAM RAMSAY by F. G. DONNAN, XIX + 148 p. London, CONSTABLE, 1918. 1918

Saccheri, Giovanni Girolamo [San Remo, Sept. 1667-Milano 1733]. EUCLIDES Vindicatus [Milano 1733]. Edited and translated by GEORGE BRUCE HALSTED, XXX + 246 p. Chicago, Open Court, 1920. 1918

Slosson, Edwin E. JONATHAN EDWARDS as a Freudian. *Science*, vol. 52, p. 609, Dec. 24, 1920. 1918

Apropos of a note of the American philosopher and theologian, JONATHAN EDWARDS' [1703-1758] diary dated 1722, May 2. G. S.

Spallanzani, Lazare [Scandiano 1729 — Pavia 1799]. Observations et expériences faites sur les animalcules des infusions. (Les maîtres de la pensée scientifique), 2 vol., VIII + 106 + 122 p. Paris, GAUTHIER-VILLARS, 1920. [6 fr.] 1918

Reproduction de la traduction de JEAN SENEBIER, Genève 1786 (1^{re} éd. 1777). Pour juger de l'importance de cette publication, je prie le lecteur de se reporter à l'article consacré à cette œuvre fondamentale de SPALLANZANI par le regretté A. GEORGES-BERTHIER dans *Isis*, II, 209-213. Nous souhaitons le plus grand succès à cette nouvelle collection des classiques de la science! G. S.

Thomson, Sir St. Clair. JOHN COAKLEY LETTSON and the foundation of the Medical Society. (Presidential address, oct. 8, 1917). London, HODSON, 1919. 1918

LETTSON, b. in West Indies 1744 — d. 1815, was the founder of the oldest medical society. G. S.

Thorpe, T. E. JOSEPH BLACK and Belfast. *Nature*, vol. 106, p. 165. London, 1920. 1918

Apropos of HENRY RIDDELL's memoir on J. BLACK and his Belfast friends and family connections, published in the *Proc. of the Belfast Natural History and Philos. Soc.*, III, p. 49, 1919 (not seen). G. S.

S. XIX

A. — Mathematics

Archibald, R. C. Geometrography and other methods of measurement of geometrical constructions. *The American mathematical monthly*, t. 25, p. 37-38, 1918. 1918

Short bibliographical note on geometrography, that is, the art of geometrical constructions, invented by EMILE LEMOINE (1840-1912). His first memoir on this subject appeared in 1888 and he summed up his theory in his *Geometrographie*. Paris 1902. G. S.

Archibald, R. C. Gauss and the regular polygon of seventeen sides. *American mathematical monthly*, vol. 27, p. 323-326, 1920. 1918

Cajori, Florián. AUGUSTUS DE MORGAN on divergent series. *Bull Amer. Math. Soc.*, vol. 27, p. 77-81, 1920. 1818

CAJORI shows that DE MORGAN deserves to be ranked as a pioneer in the development of the modern theories of divergent series. G. S.

Cremona, Luigi Opere matematiche pubblicate sotto gli auspici della R. Accademia d. Lincei, t. I-III. Milano, HOEPLI, 1914, 1915, 1917. 1818

The third volume contains a biography by E. BERTINI. G. S.

Plummer, H. C. The present position of celestial mechanics. *Scientia*, xxix, 1-12, 1^{er} janv. 1921. Traduct. française : supplément 1-11. 1818

Revue des grandes étapes parcourues par la mécanique céleste depuis le milieu du XIX^e siècle. L. G.

Gauss, Carl Friedrich [1772-1855]. Werke. Hrg. v. d. kgl. Gesellschaft der Wissenschaften zu Göttingen. 10. Bd, 1te Abteilung, 586 p. 4^o. Leipzig, TEUBNER, 1917. 1818

Contains Nachträge zur reinen Mathematik. — This publication of GAUSS' Works began in 1866. G. S.

Hermite, Charles [1822-1901]. Œuvres publiées sous les auspices de l'Académie des sciences, par EMILE PICARD, t. IV [et dernier], VI + 594 p. Paris, GAUTHIER-VILLARS, 1917. 1818

Ce dernier volume contient les travaux de 1880 à 1901, et les portraits d'HERMITE parus dans les vol. I-III, y sont complétés par une reproduction de la médaille due à CHAPLAIN. Plusieurs notices biographiques (discours académiques, etc.) sont mêlées aux mémoires mathématiques. Le tome I parut en 1905. G. S.

Klein, F.; Brendel, M. und Schlesinger, L. (editors) Materialien für eine wissenschaftliche Biographie von GAUSS. Heft I-VII. Leipzig, TEUBNER, 1911-1919. 1818

I. 1911. P. BACHMANN. Ueber GAUSS' zahlentheoretische Arbeiten, 54 S. — II. 1912. C. F. GAUSS. Fragmente zur Theorie des arithmetisch-geometrischen Mittels aus den Jahre 1797-1799, hrg. u. erläutert v. L. SCHLESINGER, 34 S. — III, 1912. L. SCHLESINGER. Ueber GAUSS' Arbeiten zur Funktionentheorie. 143 S. — IV. 1918. A. GALLE. GAUSS als Zahlenrechner, 24 S. — V. 1918. P. STRÄCKEL. GAUSS als Geometer. 142 S. — VI. PH. MAENNCHEN. Die Wechselwirkung zwischen Zahlenrechnen und Zahlentheorie bei GAUSS, 47 S. — VII. 1919. Ueber die astronomischen Arbeiten von GAUSS. I. Theoretische Astronomie, 106 S. (Some at least of these papers are reprints from the *Nachrichten d. k. Ges. d. Wiss. zu Göttingen, Math. Physik. Klasse*). G. S.

Loeber, Kurt Beiträge zur Lösung und Geschichte des Malfattischen Problems und seiner Erweiterungen. (*Diss.*), VIII + 62 S. Halle a. S., 1914. 1818

Lorey, Wilhelm. Das Studium des Mathematik an den deutschen Universitäten seit Anfang des 19 Jahrhunderts, XII + 431 S., 13 Abb., 4 Taf. (*Abhdl. in den mathematischen Unterricht in Deutschland*, III, 9). Leipzig, TEUBNER, 1916. 1818

B. — *Physical sciences and technology.*

Auerbach, Felix [1856-]. **ERNST ABBE** [1840-1905]. Sein Leben, sein Wirken, seine Persönlichkeit, nach den Quellen und aus eigener Erfahrung erschildert. (*Grosse Manner*, Bd. 5), xv + 512 S., Bildn. u. Abb. Leipzig, Akademische Verlagsgesellschaft, 1918.

1818

The same author has published (same publisher, 1919) a shorter biography (48 p.) in the collection edited by the « SIEMENS-RING Stiftung zur Ehrung grosser Männer der Technik und der technischen Wissenschaften ».

G. S.

Berzelius, Jac. Lettres publiées au nom de l'Académie royale des sciences de Suède par H. G. SODERBAUM. Vol. II contenant les fasc. 4 et 5. Uppsala, ALMQUIST, 1915-1916.

1818

For the preceding parts see *Isis*, I, 555; II, 275 — IV. Correspondance entre BERZELIUS et P. L. DULONG (1819-1837), 127 p.; 14 letters from DULONG and 26 from BERZELIUS. Portrait (A. TARDIEU's engraving) — V. Correspondance entre BERZELIUS et G. J. MULDER (1834-1847), 356 p., 33 letters from BERZELIUS and 43 from the Dutch chemist GERARDUS JOHANNES MULDER (1802-1880); with a biography and portrait of MULDER.

G. S.

Buxbaum, Bertold. Der deutsche Werkzeugmaschinen- und Werkzeugbau im 19. Jahrhundert. *Beitr. zur Gesch. d. Technik u. Industrie*, Bd. 9, S. 97-129, 21 Abb. Berlin, 1919.

1818

Divided into 3 periods: 1. English influence down to about 1870 (p. 97-117). 2. American influence. 3. Autonomous development, from about 1879.

G. S.

Fischer, Hugo. Der Bickfordsche Sicherheitszünder und die Errichtung der ersten Sicherheitszünderfabrik in Deutschland. *Beitr. z. Gesch. d. Technik u. Industrie*, t. 6, p. 55-78, 22 fig. Berlin, 1915.

1818

This history begins with the granting of Patent no. 6159, on Sept. 6, 1831 to WILLIAM BICKFORD of Tuckingmill in Cornwall for his « miner's safety fuze ».

G. S.

Fresnel, Augustin. [Broglie, Eure 1788 — Ville d'Avray 1827]. — De la Lumière. (Les Classiques de la Science, V) xiv + 132 p., 5 grav., 1 pl. Paris. ARMAND COLIN, 1914.

[2 fr. 50] 1818

Pour le compte rendu des quatres premiers volumes de cette collection, voir *Isis*, I, 770 et II, 277-279. Ce nouveau volume préparé par HENRI ABRAHAM, est consacré à l'article didactique « de la lumière » dans lequel FRESNEL résumait la marche de ses idées et l'ensemble de sa théorie. Cet article parut en 1822 dans le supplément à la traduction française de la Chimie de THOMSON. Le texte est conforme à celui inséré, avec les corrections de l'auteur, dans les œuvres de FRESNEL, Paris, 3 vol. 1866. G. S.

Gibbs, Willard. — L'équilibre des substances hétérogènes. Exposé abrégé, traduit et complété de notes explicatives par G. MATISSE, viii + 102 p. Paris, GAUTHIER-VILLARS, 1919.

1818

A translation of GIBBS' memoir published in the *American Journal of Science*, 1878, with commentary.

G. S.

Harrow, Benjamin. Eminent chemists of our time, xvi + 248 p., illustr. New York, VAN NOSTRAND, 1920. [2 \$ 50] 1818

A series of popular biographies of contemporary chemists: PERKIN, MENDELÉEFF, RAMSAY, RICHARDS, VAN 'T HOFF, ARRHENIUS, MOISSAN, MARIE SKŁODOWSKA CURIE, VICTOR MEYER, IRA REMSEN, EMIL FISCHER. There are good photographs and other illustrations and each essay is followed by a short critical bibliography. Some of the biographical material comes from private sources (MENDELÉEFF, RICHARDS, ARRHENIUS, Mad. CURIE, REMSEN, FISCHER). The value of this book would be much greater if we knew exactly which parts of it are original. The scientific and literary level of these essays is not very high, but they may prove stimulating to young or uneducated readers. G. S.

Hellman, G. Ein Streit über das Vorhandensein des Luftdrucks im XIX. Jahrhundert. *Beitr. zur Gesch. d. Meteorologie*, t. II, p. 324-329. Berlin, 1917. 1818

Apropos of nineteenth century writings denying the existence of atmospheric pressure! G. S.

Keller, Karl. JAMES B. FRANCIS. Zum hundersten Wiederkehr seines Geburtstages. *Beitr. zur Gesch. d. Tech. u. Industrie*, t. VI, p. 79-94. Berlin, 1915. 1818

JAMES BICHENO FRANCIS, American engineer, inventor of the FRANCIS turbine (an inward-flow hydraulic turbine), born in Southleigh, Oxfordshire, May 15, 1815, died Sept. 18, 1892; biography with portrait and bibliography. G. S.

Kremers, Edward. The two sons of a Danish apothecary. *Journal of the American pharmaceutical association*, vol. 7, p. 620-625, 4 illustr. July, 1918. 1818

Apropos of HANS CHRISTIAN OERSTED and his brother ANDERS SANDØE OERSTED (1778-1860), a jurist who became prime-minister of Denmark. Mr. KREMERS shows that it is these two, who are the heroes of ANDERSEN's tale "The two brothers". He also speaks of their birthplace, Rud Kjøebing, in the little island of Langland, opposite the Kiel harbor. G. S.

Le Chatelier, Henry. La fusion du platine et dissociation. *Mémoires de Sainte-Claire Deville, Debray, Troost, Hautefeuille, Isambert, Ditte, Joannis, Joly.* (*Les Classiques de la Science*, vi), xii+120 p., 4 grav. Paris, COLIN, 1914. 1818

Collection of the original memoirs by Henry Sainte-Claire Deville (la Martinique 1818-1881) and his school, as published between 1855 and 1884. With biographical notices. G. S.

Linde, Carl von. Aus der Geschichte der Kältetechnik. *Beitr. zur Gesch. d. Technik und Industrie*, t. VIII, p. 1-34, 17 Abb. Berlin, 1918. 1818

Extracts from the great inventor's autobiography, published under the title: "Aus meinem Leben und von meiner Arbeit". G. S.

Meyer, Richard [1846-]. VIKTOR MEYER [1848-1897]. Leben und Wirken eines deutschen Chemikers und Naturforschers. (*Grosse Männer*, 4). xv + 471 S., Bildn., Abb. Leipzig, Akademische Verlagsgesellschaft. 1917. 1818

Mieli, Aldo. L'origine della Gazzetta chimica italiana. *Archivio di storia della scienza*, I, p. 460-461. Roma, 1920. 1818

Founded by CANNIZZARO and EMANUELE PATERNÒ [1847-] in 1871; now published by the Associazione italiana di chimica generale ed applicata, Roma, via Tre Novembre, 154. G. S.

Moissan, Henri. [Paris, 1852 — Paris 1906]. Le Fluor. (*Les Classiques de la Science*, VII), XIV + 97 p. Paris, COLIN, 1914. [2 fr. 50] 1818

This volume edited by HENRI GAUTHIER contains MOISSAN's original memoirs on fluorine, as they appeared in the *Annales de Chimie et de Physique* and the *Comptes Rendus* between 1885 and 1891. They were later republished in bookform: Le Fluor, Paris 1900. The text here reproduced is that of the original memoirs, save that the original notation in equivalents has been replaced by the atomic notation employed by MOISSAN only in his book of 1900. G. S.

Oechelhaeuser, Wilhelm von. Ein Beitrag zur Geschichte der Grossgasmachine. *Beitr. zur Gesch. d. Technik u. Industrie*, t. VI, p. 109-151, 21 Fig. Berlin, 1915. 1818

Picard, Emile. Notice historique sur la vie et l'œuvre de Lord KELVIN, lue dans la séance publique annuelle de l'Académie des Sciences du 22 décembre 1919, 40 p. Paris, GAUTHIER-VILLARS, 1920. 1818

Thomälen, Adolf. Zur Geschichte der Dynamomaschine. Die Entwicklung des Dynamobaues bei der Firma SIEMENS und HALSKE (1866 bis 1878). *Beitr. zur Gesch. d. Technik u. Industrie*, Bd. 7, S. 134-168, 16 Fig. Berlin, 1917. 1818

Zeeman, P. Les lignes spectrales et les théories modernes de la physique. — *Scientia*, XXIX, p. 13-21, 1^{er} janv. 1921. 1818

Les progrès de l'analyse spectrale depuis NEWTON, avec exposé des théories de RUTHERFORD, BOHR, SOMMERFELD. L. G.

C. — Natural sciences

Béguinot, Augusto e Zenari, Silvia. Illustrazione dell'erbario composto da G. B. BROCCHI in Egitto e Nubia (1822-1826). Cenni introduttivi. *Archivio di Storia della Scienza*, I, p. 387-396. Roma, 1920. 1818

GIAMBATTISTA BROCCHI, b. Bassano (Veneto) 1772, d. Khartum 1826, is better known as a geologist and paleontologist; yet he was an encyclopedic naturalist. The present paper is chiefly devoted to his botanical work in Egypt. It also contains a short biographical sketch with complete bibliographical references, and a portrait. G. S.

Béguinot, Augusto e Zenari, Silvia. Illustrazione dell'erbario composto da G. B. BROCCHI in Egitto e Nubia (1822-1826). *Archivio di Storia della Scienza*, II, p. 65-69, 185-198. Roma, 1921 1818

Du Bois-Reymond, Emil [1816-1896] Jugendbriefe an EDUARD HALLMANN. Zu seinem hundersten Geburtstage hrg. v. ESTELLE DU BOIS-REYMOND. 156 S. Berlin, REIMER, 1918. 1818

Du Bois-Raymond, Emil. Aus seinem Briefwechsel über die Geschichte der Naturwissenschaften (Schluss). *Mittl. zur Gesch. d. Medizin*, t. 19, p. 1-8, 1920. 1818

See *Isis*, III, 346.

- Duclaux, Emile.** PASTEUR The history of a mind. Translated by Erwin F. Smith and Florence Hedges. xxxii + 363 p. Philadelphia, SAUNDERS, 1920. 1818

The original work : PASTEUR, *Histoire d'un esprit*, appeared in 1896.

- Ihmels, Carl.** Die Entstehung der organischen Natur nach SCHELLING, DARWIN und WUNDT. Eine Untersuchung über den Entwicklungsgedanken, vi + 104 S. Leipzig, DEICHERT, 1916. 1818

- Kraus, Edward.** The future of mineralogy in America. *Science*, vol. 53, p. 219-226. March 11, 1921. 1818

The period of early development, 1785-1850: The earliest papers appeared in 1785 in the *Memoirs of the American Academy of Arts and Sciences*; BENJAMIN SILLIMAN was appointed in 1802 professor of chemistry, mineralogy, etc. in Yale. — The period of expansion, 1850-1900 — The modern period 1900-1920. G. S.

- Merrill, George P. (editor).** Contributions to a History of American [that is, U. S.], state geological and natural history surveys. Smithsonian Institution, U. S. National Museum, Bull. 109, xviii + 549 p., illustr. Washington, 1920. 1818

Collection of administrative and other materials which will be indispensable to any historian of geology, or of science in general, in the U. S. The period dealt with is roughly from 1830 to 1885, but one survey at least (N. Carol.) began in 1824 (to be interrupted in 1828) and many documents bring us down to 1900. An excellent feature is the publication of a large amount of portraits, the more so that portraits of scientists, except the greatest, are often very difficult to obtain. Elaborate index. G. S.

- Wolkenhauer, W.** Aus der Geschichte der Kartographie. Kartographische Bibliographie, 1840-1917. *Deutsche geographische Blätter*, Bd. 38, p. 157-201, Bremen, 1917. 1818

Die moderne Kartographie ist charakterisiert durch die mit der Kippregel aufgenommenen Isohypsenkarten, durch die Einführung der Photographie (Photogrammetrie), durch die bedeutend fortgeschrittene Technologie für die Reduktion und Reproduktion der Karten, durch die Anwendung verschiedener Farben zur Höhendarstellung, durch die reliefartigen Kurvenkarten und den Stand unserer Schulkartographie. Ferner ist die Kartenentwurfslhre durch die theoretischen Untersuchungen Tissots in ein neues Stadium übergeführt. — A list of the main maps, geographical books and events in chronological sequence with critical notes, forming so to say, a summary of the annals of cartography. Six other such lists have been published for the previous periods in the same periodical from Bd. 27 (1904) on. G. S.

D. — Medical sciences

- Du Mez, Andrew G.** A century of the United States pharmacopoeia, 1820-1920 I. — The Galenical oleoresins *Bulletin of the University of Wisconsin* no. 764 (also in *Transactions of the Wisconsin Academy*, vol. xii), 288 p. Madison, Wisc. 1917. 1818

- Flexner, Simon.** Twenty-five years of bacteriology : a fragment of medical research. *Science*. vol. 52, p. 615-632, Dec. 31, 1920. 1818

Immunity. Anaphylaxis. Filterables. Spirochetes. Chemotherapy. Infection and survival. G. S.

Lister, Lord. Six papers. With a short biography and explanatory notes by Sir RICKMAN J. GODLEE, Bt. (*Classics of medicine* ed. by CHARLES SINGER) VIII + 194 p., 4 pl. and 1 autograph letter. London, JOHN BALE, 1921. [10 s.] 1818

The six papers edited by LISTER's son-in-law are : On the early stages of inflammation 1858 ; on anaesthetics, 1861 ; on a new method of treating compound fractures, abscesses, etc. 1867 ; demonstrations of antiseptic surgery before members of the British medical association, 1875-1876 ; on the nature of fermentation, 1878 ; address on the present position of antiseptic surgery delivered before the international medical congress, Berlin 1890. The editor has provided a short preface to each of these papers and contributed a biography (25 p.) containing the essential facts. 1865 was the birth year of Antiseptic Surgery, though LISTER's first publication on this subject dates of 1867 (quoted above). A useful little book. G. S.

E. — *Alia*

Bordeaux, Albert. Histoire des sciences physiques, chimiques et géologiques au XIX^e siècle. 662 p. Paris, BÉRANGER, 1920. 1818

This book divided in two parts, and the first part in 7 chapters : (1) mechanics and molecular physics ; (2) electricity ; (3) acoustics ; (4) heat ; (5) optics ; (6) chemistry ; (7) geology. The second part contains a series of tabloid biographies of the main scientists referred to in the first part — I cannot understand how the author has been able to persuade an important firm to publish a book as immature as this one. It is truly a monument of half-baked knowledge and muddled thinking. G. S.

Chamberlin, Thomas Chrowder. The founding of the Wisconsin academy of sciences, arts and letters. *Science*, vol. 52, p. 1-8, July 2, 1920. 1818

It was founded on Feb. 16, 1870. CHAMBERLIN retraces the history of the first half-century of this young academy. G. S.

Eymieu, Antonin. La part des croyants dans les progrès de la science au XIX^e siècle. Première partie : dans les sciences exactes, 3^e édition, II + 272 p. Paris, PERRIN, 1920. [5 fr.] 1818

Reviewed by D. E. SMITH in *Bull. Amer. Math. Soc.*, vol. 27, p. 29-31, 1920. Superficial and unconvincing : « a much stronger case could have been made and legitimately made, if the author had studied the problem with greater care ». G. S.

Fay, Charles Ryle. Life and labour in the nineteenth century. Being the substance of lectures delivered at Cambridge University in the year 1919, VIII + 319 p. Cambridge University Press, 1920. 1818

Loria, Achille. KARL MARX. Transl. from the Italian, with a foreword by EDEN and CEDAR PAUL, 92 p. London, ALLEN, 1920. 1818

Maine de Biran [Bergerac 1766-1824]. — Mémoire sur les perceptions obscures... Publié par PIERRE TISSERAND (Les Classiques de la Philosophie, XII), XII + 67 p. Paris, COLIN, 1920. [3 fr.] 1818

The « Mémoire sur les perceptions obscures ou sur les impressions générales affectives et les sympathies en particulier » here published for the first time *in extenso* was read by MAINE DE BIRAN in 1807 before the « Société médicale de Bergerac » founded by him. This text is followed by four notes in which MAINE DE BIRAN discusses the opinions respectively of ROYER

COLLARD, CH. V. DE BONSTETTEN, THOMAS REID and DUGALD STEWART. These notes are published from the MSS. and for the first time except the first already published by GÉRARD. The editor has added biographic and bibliographic notes; the latter chiefly devoted to the MSS. is of particular interest. There are still many unpublished MSS., the bulk of which is at the library of the "Institut de France" (fonds NAVILLE). G. S.

Marvin, F. S. (editor) Recent developments in European thought. Essays arranged and edited by him. 306 p. (*The Unity Series*) Oxford University Press, 1920. 1818

Mély, F. de. L'abbé MIGNE. L'homme et l'œuvre. Revue archéologique, t. I, p. 203-258. Paris, 1915. 1818

An extensive biography of the famous editor of the *Patrologies latine et grecque*, the largest collection of original texts ever published. The abbé MIGNE was born in Saint-Flour, Oct. 25, 1800, he died in Paris, Oct. 24, 1875. The original plan of his collection foresaw the publication of 1000 large 4o vol. (he edited 979 vol.). He was a man of great learning and almost unbelievable activity, a business man of genius, an extraordinary character. Three portraits of his are reproduced. G. S.

Raven, Charles E. Christian socialism, 1848-1854. London, MACMILLAN, 1920. 1818

Smith, David Eugene. DELAMBRE and the founder of the Smithsonian Institution. (Among my autographs, I) *American mathematical monthly*, t. 28, p. 64-65, 1921. 1818

A letter from J. B. J. DELAMBRE (1749-1822) to the Comte d'HUNEBOURG, Minister of War, to recommend to his benevolence JAMES SMITHSON, prisoner of war. Dated Paris 16 April 1809. G. S.

S. XX

Fuller, John Frederick Charles. Tanks in the Great War, 1914-1918, xxiv + 331 p., 7 pl. London, MURRAY, 1920. 1818

Hall, Thomas F. [1841-]. Has the North Pole been discovered? An analytical and synthetical review of the published narratives of the two Arctic explorers FREDERICK A. COOK and ROBERT PEARY, also of a review of the action of the U. S. government, 539 p., maps, charts etc. Boston, BADGER, 1917. 1818

HALL contends that neither COOK nor PEARY reached the pole. G. S.

Schmid, Bastian (editor). Deutsche Naturwissenschaft, Technik und Erfindung im Weltkrieg. 26 cm., xvi+1008 S., Abbild. München, O. NEMNICH, 1919. 1818

A survey of scientific and technical progress made in Germany during the war, each chapter being contributed by a specialist. Introductory chapters deal with "Science and Culture" (RUDOLF STÜBE) and with the "Psychology of war and invention" (ROBERT SOMMER). The subjects considered are: physics; meteorology (S. GÜNTHER); aeronautics; photography; chemistry; ballistics; arms; technology; transportation and communications; geology; geography; ethnology; botany; zoology; bacteriology; hygiene; medicine and various medical branches (9 chapters); husbandry; forestry; scientific education (2 chapters). A final chapter treats the economical aspect of war. The treatment is popular throughout; this explains perhaps the omission of chapters devoted to mathematics and in the medical part, to sexual diseases. G. S.

Materials for the biography of contemporary scientists

(chiefly obituary notices)

I would be very grateful to readers of this section who happen to have complete information on some contemporary scientist, if they would kindly communicate it to me, especially if they would take the trouble to arrange it in conformity to the following notices, that it may be published without change.

G. S.

Abney, Sir William de Wiveleslie (1843, July 24-1920, Dec. 2). Spectroscopy (infra-red), scientific photography. A. E. H. TUTTON in *Nature*, vol. 106, p. 476-477, 1920. 1818

Ameghino, Florentino (1854-1911). South American palaeontology. An account of his life and works fills the first volume of his complete works published by the Argentine government: *Obras completas y correspondencia científica*. Ed. oficial, dirigida por A. J. TORCELLI, vol. I. Vida y obras del sabio. La Plata 1913; José INGEGNIEROS, Las doctrinas de A.; la tierra, la vida y el hombre, 221 p. Buenos Ayres, 1919. 1818

Andoyer, Henry (Paris, 1862 Oct. 1). Mathematics, astronomy (celestial mechanics). — G. BOUCHENY in *Larousse Mensuel*, t. 5, p. 29-30, 1920, with portrait and bibliography. 1818

Arnot, Frederick Stanley (—Johannesburg, 1914 May). Missionary, explorer. ERNEST BAKER. The life and explorations of FREDERICK STANLEY ARNOT, 334 p. London, SEELEY, 1920. 1818

Atkinson, George Francis (Raisinville, Mich. 1854-Tacoma, Wash. 1918). Botany. HARRY M. FITZPATRICK in *Science*, vol. 49, p. 371-372, 1919. 1818

Backlund, Oscar (Langhem, Wermland, 1846-Pulkovo, 1916). Astronomy. G. BIGOURDAN in *Rev. génér. d. sci*, t. 27, p. 701-702, 1916. 1818

Baeyer, Adolf von (Berlin, 1835-1917). Organic chemistry. W. H. PERKIN, *Nature*, vol. 100, p. 188-190, 1917; G. B. in *Geschichtsb. f. Technik*, IV, 158-160, 1917; RICHARD WILSTÄTTER in *Jahrbuch d. Bayer. Ak. d. Wiss.*, 1918. *Gesammelte Werke*, 2 Bde. Braunschweig, VIEWEG, 1905 (contains biogr. and autobiogr. information). 1818

Baird, John Wallace (W. Ontario, 1869 or 1873-Baltimore, 1919). Psychology. E. B. TITCHENER in *Science*, vol. 49, p. 393-394, 1919. 1818

Barrell, Joseph. (Providence, N. J. 1869-New Haven 1919). Geology. CHARLES SCHUCHERT in *Science*, vol. 49, p. 605-607, 1919; *Scientific monthly*, IX, p. 93-96 (portrait), 1919. 1818

Bartholomew, John George (Edinburgh, 1860, March 22-Cintra, 1920, April 13). Cartography. Geo. G. CHISHOLM in *Nature*, vol. 105, p. 238-239, 328, 1920. 1818

Battelli, Angelo (1862 March 28-1916 Dec. 11). Physics. *Revue génér. des sc.*, t. 28, p. 257, 1917; G. BILANCIONI. *Riv. di Storia critica*, t. 7, p. 200-201, 1916. 1818

- Beck, Theodor** (Darmstadt, 1839 June 3-ibid. 1917, July 30) History of science and technology. F. M. FELDHAUS in *Geschichtsbibl. f. Technik*, t. IV, p. 161-162 (with portrait), 1917. 1818
- Berendes, Julius**. (Paderborn, 1837 March 23-Goslar, 1914 July 6). History of pharmacy. HERM. SCHELENZ, *Mitt. zur Gesch. d. Medizin*, t. 13, p. 620-621, 1914. 1818
- Billings, John Shaw** (1838-1913). Bibliography; history of medicine. *Isis*, III, 120. FIELDING H. GARRISON, JOHN SHAW BILLINGS, 432 p. New York, PUTNAM, 1915; S. WEIR MITCHELL and F. H. GARRISON, *National Acad. of Sciences*, vol. VIII, p. 375-416, 1917. 1818
- Blanchard, Raphael** (1858 or 1857-1919). History of medicine, medical zoology. F. H. GARRISON in *Science*, vol. 49, p. 391-392, 1919; K. SUDHOFF, *Mit. zur Gesch. d. Medizin*, vol. 18, p. 176, 1919. 1818
- Bose, Sir Jagadis C.** (Rarikhali in Vikrampur, E. Bengal 1858 Nov. 30). Physiology chiefly botanical. PATRICK GEDDES. The life and work of Sir J. C. B., xii + 259 p. London, LONGMANS, 1920; an editorial in the *London Times*, Dec. 16, 1919 entitled Eastern Monism was devoted to him; see also *Ibidem*, Dec. 17. 1818
- Bourquelot, Emile**. (Ardennes 1852?-1921 Jan. 26). Botanical chemistry, pharmacy. *Revue génér. d. sci.*, t. 32, 98, 1921; *Nature*, vol. 106, p. 836-837, 1921. 1818
- Buchka, Karl Heinrich** (Rostock 1856-1917 Febr. 16). History of chemistry; foundation of the *Archiv. f. Gesch. d. Naturwiss.* KARL SUDHOFF, *Archiv f. Gesch. d. Naturw.*, t. VIII, p. i-iv (with portrait and bibliogr.) 1917; H. BORUTTAU, *Ibid.*, p. 124-128. 1818
- Buchner, Eduard** (München 1860-1917). Physiological chemistry, fermentation. C. HARRIES, *Chemiker Z.*, p. 753; G. B. *Geschichtsbibl. f. Technik*, t. 4, 160. 1818
- Bumstead, Henry Andrews** (Pekin, Ill. 1870-1921 Jan. 1). Physics. J. J. T. in *NATURE*, vol. 106, p. 734-735, 1921; R. A. MILLIKAN, *Science*, vol. 53, 84-85, 1921. 1818
- Bureau, Edouard** (Nantes -Paris 1918). Botany, chiefly palæobotany. HENRI LECOMTE, *Rev. génér. sc.* t. 30, p. 97-98, 1919; HAYEM. Académie de médecine de Paris, 24 déc. 1918. 1818
- Burrows, Ronald M.** (1867 Aug. 16-1920). Aegean archeology. GEORGE GLASGOW, *Discovery*, I, p. 176-177; *Nature*, May 20, 1920. 1818
- Candolle, Casimir de** (Geneva, 1836-1918) Botany. R. CHODAT. *Arch. des sci. phys. et natur.*, vol. I, p. 5-28 (portrait) 1919; B. P. G. HOCHREUTNER, *Rev. génér. d. sci.*, t. 29, p. 625-626, 1918. 1818
- Candolle, Augustin Pyramus de** (England 1869-Vallon, nr. Geneva, 1920, May 9). Son of Casimir de C. Botany. Short note in *Nature*, vol. 105, p. 365, 1920. 1818
- Cantor, Moritz** (Mannheim 1829-Heidelberg 1920). History of mathematics. FLORIAN CAJORI, *Bull. Amer. math. soc.*, vol. 27, p. 21-28, 1920; KARL BOPP, *Sitzungsber. d. Heidelberger Akad. d. Wiss.*, 16 p., 1920; S. GÜNTHER, *Mit. zur Gesch. d. Med.*, t. 19, p. 222, 1920. Festschrift zum 70. Geburtstage M. C., hrg. v. M. CURTZE u. S. GÜNTHER, Leipzig, 1899; *idem.* zum 80. Geburtstage hrg. v. S. GÜNTHER u. K. SUDHOFF, Leipzig, 1909. 1818

- Carnegie, Andrew** (Dumferline, Scotland, 1835-1919). Promotion of scientific research. Autobiography, xii + 385 p. London, CONSTABLE, 1920. See also *Isis*, III, p. 347. 1918
- Chappuis, Pierre** (1855-1916). Thermometry. CH. ED. GUILLAUME, P. CH. et le développement moderne de la thermométrie, *Revue génér. des sci.*, t. 27, p. 204-208, 1916; AUG. HAGENBACH, *Verhdl. d. Naturf. Ges.*, Basel, t. 27, p. 87-92, 1916. 1918
- Chavannes, Emmanuel Edouard** (Lyon 1865-Paris 1918). Sinology. *Isis*, III, p. 120; SAMUEL COULING, *New China review*, I, p. 7-10, (portrait). Hongkong, 1919. 1918
- Chun, Carl** (1852-1914). Marine zoology. F. SCHWANGART, *Z. f. angew. Entom.*, I, p. 373-374, 1914; W. PFEFFER, *Ber. ü. die Verhdl. d. Kgl. Sächs. Ges. d. Wiss., Math. phys. klasse*, t. 66, p. 179-193. Leipzig, 1914. 1918
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- Schloesing, Jean Jacques Théophile** (Marseille, 1824-Paris, 1919). Agricultural chemistry. L. GUIGNARD, *Revue scientifique*, 1919, p. 503-504; G. ANDRÉ, *Revue génér. d. sci.*, t. XXX, p. 293-295, 1919; PAUL EHRENBURG, *Chemiker Z.*, p. 305, 1919. 1818
- Schwarzchild, Karl** (Frankfurt a. M., 1873-1916). Astronomy, physics. OTTO BLUMENTHAL, *Jahresber. d. deuts. math. Ver.* t. XXVI, p. 56-75, 1917; ALBERT EINSTEIN, *Sitzungsber. d. preuss. Ak. d. Wiss.*, p. 768, 1916. 1818
- Scott-Moncrieff, Sir Colin (Campbell)** (1836-1916). Engineering. MARY ALBRIGHT HOLLINGS, the life of Sir C. C. S. M., edited by his niece, XII + 374 p., illustr. London, MURRAY, 1917. 1818
- Smoluchowski, Marian von** (nr. Vienna, 1872 - Cracow, 1917). Molecular physics, discussion of irreversibility. ALBERT EINSTEIN, *Die Naturwissenschaften*, t. V, p. 737, 1917; R. LORENZ, *Jahresbericht des physikal. Vereins*, Frankfurt a. M., p. 3-16, 1917-1918. 1818
- Suess, Eduard** (London, 1831-Vienna, 1914). Geology. *Isis*, t. III, p. 123. W. M. DAVIS *American Journal of science*, Sept. 1919 (important); EMIL TIETZE, Einige Seiten ü. E. S., *Geol. Reichsanstalt*, Wien, 1917. 1818
- Thompson, Silvanus Phillips** (York, 1851-1916). Physics, history of physics. JANE SNEAL and HELEN G. THOMPSON, S. P. T., his life and letters, IX + 372 p. London, FISHER UNWIN, 1920; Portrait in *Scientific Monthly*, t. III, p. 311, 1916. 1818
- Turner, Sir William** (cty. of Lancaster, 1832-1916). Anatomy, comparative anatomy (Cetacea), anthropology, medicine. R. ANTHONY, *Revue génér. d. sci.*, t. XXVII, p. 165-166, 1916; A. LOGAN TURNER (his son), SIR W. TURNER, K. C. B., F. R. S. A chapter in medical history, XVII + 514 p. London, BLACKWOOD, c. 1919. 1818
- Tylor, Sir Edward Burnett** (Camberwell, 1832-1917). Anthropology, ethnology. *Nature*, t. XCVIII, p. 373-374, 1917; Anthropological essays presented to him in honour of his 75th birthday, Oct. 2, 1907,

Oxford, CLARENDON Press, 1907 (with biographical essay by A. LANG, and an extensive bibliography). 1818

Vambéry, Armin (Szerdahely, island of Schutt 1832 - Seebenstein 1913). Travel in Central Asia; Oriental philology. R. TSCHUDI, *Islam*, t. V, p. 107-108, 1914. ARMINIUS VAMBERY, Life and adventures, written by himself, 9th ed., 340 p. London. UNWIN, 1914; *Idem*, the story of my struggles, 2 vol. London, UNWIN, 1904. 1818

Vidal de Lablache, Paul (Pézenas, Herault, 1845 - Tamaris sur mer, Var, 1918). Geography. H. FROIDEVAUX, *Larousse mensuel*, t. V, p. 83-84, 1920 (portrait); GUST. REGELSPERGER, *Revue génér. d. sci.*, t. XXIX, p. 257-258, 1918. 1818

Weismann, August (1834-1914). Biology. R. VON HANSTEIN, *Naturwiss. Wochenschrift*, t. XIV, p. 113-120, 129-136; ERNST GAUPP, A. W., sein Leben und sein Werk, VIII + 297 p. Jena, FISHER 1917. GEORG JOHN ROMANES (1848-1894). An examination of Weismannism, IX + 221 p. Chicago, Open Court, 1893. 1818

Welch, William Henry (Norfolk, Conn. 1850-) Medicine. hygiene. SIMON FLEXNER, *Science*, t. LII, p. 417-433, 1920 (an introduction to the Collected Papers compiled in his honor on the occasion of his 70th birthday, 3 vol., Baltimore, JOHNS HOPKINS Press, 1920). 1818

Werner, Alfred Mulhouse, Alsace, 1866-Zurich, 1919. Chemistry inorganic, valence. *Science*, t. LI, p. 607-608, 1920; LOUIS BRUNET, *Rev. génér. d. sci.*, t. XXXI, p. 265-266, 1920; PHILIPPE A. GUYET, *Journal de chimie physique*, t. XVII, p. 638, 1919. 1818

Weyl, Theodor (1851-1913). Hygiene, history of hygiene. E. BÖRNSTEIN, *Ber. d. deutsch. chem. Ges.*, t. XLVIII, 18 p. Berlin, 1914; CARL KOEHNE, *Mit. zur Gesch. d. Medizin*, t. XIV, p. 72-73, 1915. 1818

White, Andrew Dickson (1832-1918). History of science and civilization. GEORGE LINCOLN BURR, *Nation*, p. 577-578. New York, 1918. Autobiography, 2 vol. New York, Century, 1905 (with a bibliography and portraits). 1818

Wolkenhauer, August (Bremen, 1877-1915). History of geography. — S. GÜNTHER, *Mit. zur Gesch. d. Medizin*, t. XIV, 162-165, 1915 (with bibliography). 1818

Wundt, Wilhelm (Neckarau. nr. Mannheim, 1832-1920). Psychology, philosophy. EDW. BRADFORD TITCHENER, *Science*, t. LII, p. 500-502, 1920; G. DAWES HICKS, *Nature*, t. CVI, p. 83-85, 1920. Festschrift W.W. zum 70. Geburtstage überreicht von seinen Schülern, 2 vol., Leipzig, ENGELMANN, 1902; EDMUND KÖNIG, W.W. Seine Philosophie und Psychologie, 207 p. (portrait, Stuttgart, FROMMAN, 1901; 3te. Aufl., 232 p., 1909; OSWALD PASSKÖNIG, Die Psychologie des W.W., VIII + 188 p. Leipzig, SIEGISMUND, 1912, 1818

Zeuthen, Hleronimus Georg (Grimstrup Jütland, 1839-1920). History of mathematics. GINO LORIA, *Archivio di storia della Scienza*, t. I, 447-451, 1920 (with bibliography); Festschrift til H.G. Z. fra venner og elever i anledning af hans 70 aars fødselsdag 15. Februar 1909. Koepenhavn, HOEST, 1909, 156 p. (portrait). 1818

PART II

Historical Classification

Including only the materials which could not be included in Part I,
— the fundamental (centurial) classification.

1 and 2. — ANTIQUITY

Bidez, J. La liturgie des mystères chez les néo-platoniciens. *Bull. de l'Acad. R. de Belgique (lettres)*, n° 5, p. 415-430. Bruxelles, 1919.

1818

Explaining a programme of investigations on ancient liturgy and ritual of which almost nothing is known. Such a programme could be carried through only by international cooperation. It is of real interest to the historian of science because liturgy was intimately connected with alchemy. The first step will be to make a complete catalogue of all Greek (also Latin and Oriental) Mss. dealing with alchemy and other occult sciences, oracles, or containing Orphic hymns, gnostic and hermetic writings. This is an immense undertaking but its accomplishment will give us a deeper knowledge of the ancient history of chemistry and technology and also of Hellenistic and Roman philosophy. Incidentally, BIDEZ criticizes the work of CHARLES-EMILE RUELLE, BERTHELOT's collaborator. BIDEZ does not seem to know the many papers refuting DIELS' theory that the making of alcohol is an ancient invention.

G. S.

Breasted, James Henry. The origins of civilization. Reprinted from the *Scientific Monthly*, Oct. 1919, Nov. 1919, Dec. 1919, Jan. 1920, Febr. 1920, March 1920, with many illustrations.

1818

(1) From the old stone age to the dawn of civilization; (II) The earliest civilization and its transition to Europe. These two lectures were delivered before the National Academy of Sciences in Washington in April 1919 as the 7th series of lectures on the W. E. HALE Foundation. Both the text of this great synthesis and the illustrations are extremely suggestive.

G. S.

Gardner, Percy [1846-]. A history of ancient coinage, 700-300 B.C., XVI + 463 p. Oxford, CLARENDON Press, 1918.

1818

Hellmann, G. Die Witterungsangaben in den griechischen und lateinischen Kalendern. *Beitr. zur Gesch. d. Meteorologie*, Nr. 7, Bd. II, S. 137-166. Berlin, 1917.

1818

Some ancient parapegmata contained meteorological observations, and even gave forecasts for particular days. These observations were not systematic however. The ποιεῖν and σπουδαῖν of celestial bodies was soon considered as a reality. Hence one cannot attach much value to these so-called observations. HELLMANN studies successively : (1) The Egyptian meteorol. data contained in PROLEMY's calendar; (II) the old Greek meteor. calendars; (III) COLUMELLA; POLEMIUS SILVIUS and AETIUS; (IV) CLODIUS TUSCUS.

G. S.

Lattes, Elia. De quelques objections contre les parentés italiques de l'Etrusque. *Scientia*, t. XXVII, p. 395-398. Bologna, 1920.

1818

Discussion des objections de M. MEILLET. Voir *Isis*, III, p. 470. G. S.

Lehmann-Haupt, C.F. Historisch-metrologische Forschungen. (2). Die hebräischen Masse und das pheidonische System; (3). Die Mine des Königs und die Mine (des Landes) *Klio*. t. XIV, p. 345-376. Leipzig, 1914. 1818

Schubart, Wilhelm. Einführung in die Papyruskunde, VII + 508 p. Berlin, WEIDMANN, 1918. 1818

Tenne, A. Kriegsschiffe zu den Zeiten der alten Griechen und Römer. 76 p., 8 pl. Oldenburg, STALLING, 1915. 1818

Warren, Herbert Langford (1857-1917]. The foundations of classic architecture, XIV + 357 p. New York. MACMILLAN, 1919. 1818

3. — ASIA

Ferrand, Gabriel. Le K'ouen-Louen et les anciennes navigations interocéaniques dans les mers du Sud. *Journal Asiatique*, t. XIII, p. 239-333, 431-492; t. XIV, p. 5-68, 201-241. Paris, 1919. 1818

Recueil de textes relatifs au pays de K'ouen-Louen, et aux îles que les Arabes appellent Kâmrûn et Komr; aussi de documents orientaux ayant trait aux migrations de peuples de la Haute Asie en Inde transgangétique, puis en Indonésie et de l'Indonésie occidentale à Madagascar et sur la côte d'Afrique voisine. G. S.

Saussure, Léopold de. La symétrie du zodiaque lunaire asiatique. *Journal Asiatique*, t. XIV, p. 141-148. Paris, 1919. 1818

« Le problème de l'origine et de l'évolution du zodiaque lunaire asiatique sous ses diverses formes (mânâzil arabes, nakṣastra hindous et sieou chinois) soulève des questions d'ordre historique, astronomique et philologique. » Cette courte note a pour objet d'attirer l'attention sur la symétrie diamétrale qui présente la projection des nakṣastra sur l'équateur de xxiv^e siècle av. J. C.; la projection des sieou sur le même équateur présente une symétrie beaucoup plus régulière. Les projections des nakṣastra et des sieou sur l'écliptique sont bien moins symétriques. L'auteur démontre que « le but primordial du zodiaque lunaire (ou plutôt luni-solaire) a été de déterminer le lieu sidéral du soleil par l'observation du lieu sidéral de la pleine lune, grâce à un système d'étoiles fondamentales choisies en opposition par couples; ce qui explique l'inégalité des divisions, l'admission de très petites étoiles (4^e grandeur dans l'Inde, 5^e grandeur en Chine), la diffusion de ce zodiaque d'un bout à l'autre de l'Asie et la convention traditionnelle des mêmes étoiles fondamentales ». G. S.

EASTERN ASIA

Groslier, George. La batellerie cambodgienne du VIII^e au XIII^e siècle de notre ère. *Revue archéologique*, t. 5, p. 198-204, 9 fig. Paris, 1917. 1818

A propos d'une jonque chinoise, semblable aux jonques modernes, figurée sur un bas-relief du Bayon (Angkor Thom). G. S.

Swingle, Walter T. Orientalia. Report of the Librarian of Congress for the fiscal year ending June 30, 1920, p. 187-194. Washington, 1920. 1818

The Oriental section of the Library of Congress is growing very fast as this report clearly shows. For inst. the Library contains what is perhaps the largest collection of Chinese official gazetteers to be found outside of China: it now comprises 1 025 different gazetteers!, and this includes a part of the manuscript of the great Mongol gazetteer (*Ta Yüan i t'ung chih*). Other accessions are: a copy of the classified manuscript catalogue of the Library of Canton; a Korean reprint (early xvth cent.) of T'ANG SHÊN-WEI's famous herbal (xith cent.) of which the Library owns already 7 Chinese and 1 Japanese ed., etc... The Library doubtless has the largest collection of Chinese collectanea or *ts'ung shu* outside of the Far East.
G. S.

WESTERN ASIA

Crawford, S. J. The decipherment of the Hittite language. *Journal of the Royal Asiatic Society*, p 1-13. London, January 1919. 1818

A summary of FRIEDRICH HROZNÝ's research with a short account of the Hittite question. The Hittites first appear in history in 1930 B. C. warring with Babylonia and to them is probably due the overthrow of HAMMURABI's dynasty. Their empire culminated in the xivth and xiiith cent. under SUBBILULIUMA and his successors and appears to have waned about the beg. of the xiiith cent. In the xivth and xiiith cent. Hittite was an independent Indo-European language, very closely related to Latin. — It was probably the Hittite empire which kept the Minoans out of Asia Minor, and its downfall which smoothed the path of the Achæans. CRAWFORD suggests also a possible connection between the Hittites and the Etruscans.
G. S.

Hogarth, David George. Hittite Seals. With particular reference to the Ashmolean collection, xii + 108 p., 10 pl. Oxford, CLARENDON Press, 1920. 1818

Hrozný, Friedrich. Die Sprachen der Hethiker, ihr Bau und ihre Zugehörigkeit zum indogermanischen Sprachstamen. Ein Entzifferungsversuch (*Boghazköi-Studien*, 1), xv + 246 p. Leipzig, HINRICHS, 1917. 1818

Hrozný, Friedrich. Hethitische Keilschrifttexte aus Boghazköi in Umschrift, mit Uebersetzung und Kommentar. Lief. I (*Boghazköi-Studien*, 2). Leipzig, HINRICHS, 1919. 1818

King, L. W. Note on the Hittite problem. *Journal of Egyptian archaeology*, t. 4 p 190-193. London, 1917. 1818

A criticism of F HROZNÝ's claim to have solved the problem and to have proved that the Hittite language was of Indo-European character (*Mitt. d. deutschen Orientgesell.*, no. 56, Dez. 1915).
G. S.

Strzygowski, Josef. Die Baukunst der Armenier und Europa. Ergebnisse einer vom kunsthistorischen Institute der Universität Wien 1913 durchgeführten Forschungsreise, planmässig bearbeitet. Mit 828 Abb. samt einer Karte. 2 Bde, 4°, xii + 888 S. Wien, SCHROLL, 1918. 1818

Contains a large amount of unpublished material on Armenian architecture. From the theoretical point of a view a sequel to the author's "Altai-Iran und Völkerwanderung" (*Isis*, IV, p. 189), Leipzig, 1917.
G. S.

4. — BABYLONIA AND ASSYRIA

Fotheringham, J. K. Babylonian measures and the δάκτυλος. *The Observatory*, vol. 42, p. 46-51, 1919. 1818

The Babylonian "finger" as a unit is the same as our digit, the twelfth part of the Moon's diameter.
J. L. E. D.

Landsberger, Benno. Der Kultische Kalender der Babylonier und Assyrier. (I) Die altbabylonischen Lokalkalender (*Diss.*). Leipzig, PRIES, 1914. 1818

Langdon, Stephen H. Sumerian epic of paradise, the flood and the fall of man, 98 p., 7 pl. Philadelphia, University Museum, 1915. 1818

Lehmann-Haupt, C. F. Die babylonische Zeiteinheit von 216 Minuten, ihre Beziehungen und ihre Verbreitung. *Zeitschrift für Ethnologie*, Heft 2 u. 3, p. 101-131, 1919. (published May 1920). 1818

A study of two Babylonian periods of time: the little *uddazallû* (216 minutes) and the large *uddazallû* (14 h. 24 m.). The former represents 9 sixtieths of a day and the 180th part of a sidereal month; the latter is 4 times larger and represents the duration of the longest day in Babylonia. The author discusses their relation to one another but without being able to find which was used first.
G. S.

Mercer, Samuel A. B. A Sumero-Babylonian sign list, to which is added an Assyrian sign list and a catalogue of the numerals, weights and measures used at various periods, vi + 244 p. New York, Columbia University Press, 1918. 1818

Mercer, Samuel A. B. Religious and moral ideas in Babylonia and Assyria, xiv + 130 p. Milwaukee, Wisconsin, MOREHOUSE Co, 1919. 1818

Teloni, G. C. L'écriture babylonienne et assyrienne. *Scientia*, t. 28, p. 165-200. Bologna, 1920. 1818

(I) Ce qu'en savaient les anciens; (II) Cette écriture en général; (III) Origines probables et développement; (IV) Est-il possible de retrouver l'image primitive des signes babyloniens et assyriens?

5. — BIBLE

Legge, F. The Society of Biblical Archaeology. *Journal of the Royal Asiatic Society*, p. 25-30. London, Jan. 1919. 1818

Retraces the history of this society born in 1870 and now amalgamated with the R. Asiatic Soc. — Their Proceedings are now incorporated with the *Journal of the R. A. S.*
G. S.

Masterman, E. W. G. Hygiene and disease in Palestine in modern and in biblical times, xv + 69 p., 5 pl. London, Palestine exploration fund, 1919. 1818

Naville, Edouard. The text of the Old Testament. The SCHWEICH lectures, 1915, viii + 82 p. London, MILFORD, 1916. 1818

Thomsen, Peter. Die Palästinaliteratur. Eine internationale Bibliographie in systematischer Ordnung, Bd. I-III. Leipzig, 1895-1914.

1818

Thomson, Peter Palästina und seine Kultur in fünf Jahrtausenden. Nach den neuesten Ausgrabungen und Forschungen dargestellt. 2 neubearb. Auflage (*Aus Natur und Geisteswelt*), 127 p., 37 illustr. Leipzig, TEUBNER, 1917.

1818

6. — BYZANTIUM

Diehl, Charles. Histoire de l'empire byzantin, xi + 247 p. Paris, PICARD, 1919.

1818

Excellent summary containing lists of emperors, chronological tables, etc.
G. S.

7. — CHINA

Boyer, A. M.; Rapson, E. J. and Senart, E. Kharoṣṭhī Inscriptions discovered by Sir AUREL STEIN in Chinese Turkestan. Part I : Text of inscriptions discovered at the Niya site, 1901, transcribed and edited. Royal 4°, viii + 154 p., 6 pl. Oxford, CLARENDON Press, 1920

1818

Dingle, Edwin John (*editor*). The new atlas and commercial gazetteer of China. A work devoted to its geography and economic and commercial development. Containing 25 bilingual maps with complete indexes and many coloured graphs. Compiled and translated from the latest and most authoritative surveys and records. Shanghai, North China Daily News and Herald, [1917].

1818

Erkes, Eduard und Schindler, Bruno. Zur Geschichte der europäischen Sinologie. *Ostasiatische Zeitschrift*, t. V, p. 105-115. Berlin, 1917.

1818

Interesting summary of Sinological studies in various European countries and in the United States.
G. S.

Petrucchi, Raphael (1872-1917). Chinese painters. A critical study with a biographical note by LAURENCE BINYON, 25 illustr., 155 p. New York, BRENTANO, 1920.

1818

Saussure, Léopold de. Le système astronomique des Chinois. *Archives des sciences physiques et naturelles*, vol. 1, p. 186-216, 561-588, illustr. Genève, 1919.

1818

This very important publication does not duplicate the author's previous publ. in *T'oung Pao*, 1909-1914 (see *Isis*, t. III, p. 131). The latter were written for sinologists, the former for astronomers; they complete one another. GINZEL's account of Chinese astronomy (*Hdb. d. Chronologie*, I, 1906) is entirely wrong. A knowledge of ancient Chinese astronomy (that is anterior to the Burning of the Books, B. C. 213) is necessary to understand the cosmological beliefs upon which Chinese civilisation is based. The memoir is subdivided as follows: (I) Description du système; (II) Preuves de son antiquité; (III) Rôle fondamental de l'étoile polaire; (IV) La théorie des cinq éléments; (V) Changements dynastiques et réformes de la doctrine.
G. S.

Saussure, Léopold de. Le système astronomique des Chinois. *Archives des sciences physiques et naturelles*, t. 2, p. 214-231, 325-350, illustr. Genève, 1920. 1918

(VI) Le symbolisme zodiaque ; (VII) Les anciens mois tures ; (VIII) Le calendrier ; (IX) Le cycle sexagésimal et la chronologie ; (X) Les erreurs de la critique. « Les Chinois ont su élaborer, en perfectionnant le zodiaque lunaire, asiatique, un système astronomique très remarquable, basé, au point de vue tropique, sur le solstice d'hiver ; au point de vue sidéro-solaire, sur la détermination des lieux du soleil par ceux de la pleine lune ; au point de vue calendérique sur la concordance des lunaisons cardinales avec le milieu des saisons ; au point de vue cosmologique sur la division du firmament en cinq parties dont une centrale (polaire) et quatre périphériques.... On aurait tort de supposer que ce système impliquât une exacte connaissance des mouvements célestes et une grande précision des observations.... La seule opération vraiment précise de l'astronomie antique est l'établissement de la symétrie des étoiles déterminatrices, qui date de l'époque créatrice [dans la haute antiquité]... La grande valeur du système chinois ne réside pas dans la précision de détail, mais dans son caractère synthétique et déterministe.... Il représente la plus ancienne conception unitaire, synthétique et déterministe du monde. Et depuis les origines jusqu'à nos jours, il a constitué le cadre intellectuel de la civilisation chinoise » (p. 348-350).

G. S.

Saussure, Léopold de. Une Société des Nations dans l'antiquité chinoise. *Journal de Genève*, 16 février 1920, (2 col.). 1918

Schindler, Bruno. Die Prinzipien der chinesischen Schriftbildung. *Ostasiatische Zeitschrift*, t. IV, p. 284-315. Mit 18 Schrifttafeln. Berlin, 1916. 1919

Stübe, R. Die Erfindung des Druckes in China und seine Verbreitung in Ostasien. *Beitr. zur Gesch. d. Technik u. Industrie*, t. 8, p. 82-93. Berlin, 1918. 1918

(I) China ; (II) Japan ; (III) Korea.

G. S.

8. — EGYPT

Breasted, James Henry. The earliest boats on the Nile. *Journal of Egyptian archæology*, t. IV, p. 174-176, 2 pl. 1917; cfr. also *Ibid.* p. 255. 1918

Apropos of the Nubian reed-floats observed by the author and compared by him to the earliest Egyptian boats and to the « catamaran » so common in Pacific and Malay waters. « It is quite evident that Egyptian navigation by way of the Red Sea affected devices in the East Indian world, just as it did in the Mediterranean » — The reed « catamarans » used by fishermen on the west coast of South America may possibly belong to the same family ?

G. S.

Capart, Jean. Les origines de la civilisation égyptienne. Conférence faite à la Société d'Anthropologie de Bruxelles, le 27 avril 1914. 34 p. + xvi pl. Bruxelles. VROMANT, 1914. 1918

Les monuments préhistoriques égyptiens nous viennent exclusivement des nécropoles de la Haute-Egypte. Cependant il est très probable que la civilisation pharaonique est originaire du Delta. La civilisation primitive du Delta était probablement complexe : libyenne — sémitique ; c'était une civilisation non pas continentale, mais méditerranéenne. Plus tard les vrais Égyptiens du Delta envahirent la Haute Egypte jusqu'alors habitée par une population africaine. G. S.

Capart, Jean. Les monuments dits Hycsos (Recherches d'art égyptien, 1) Réimprimé des *Annales de la Société royale d'Archéologie de Bruxelles*, t. XXVII, 1913, p. 121-156, 46 p. Bruxelles, VROMANT, 1914. [6 fr.] ISIS

CAPART's theory is briefly that the monuments called Hycsos by MARIETTE, attributed by GOLENISCHEFF to the XIIIth Dyn. and by PETRIE to the end of the Old Kingdom really belong to a period anterior to the IVth dyn., that is to a period of artistic formation. On the basis of an artistic analysis CAPART puts these monuments in the following order : LUDOVISI bust, Tanis carriers, Fayoum bust, Tanis sphinx. I must confess that CAPART's argument has not destroyed my confidence in GOLENISCHEFF whose comparisons between the Tanis sphinxes and the statue of AMENEMHET III are very striking. But CAPART's theory may be correct with regard to the other monuments. There is a long way from the LUDOVISI bust to the Tanis sphinxes ! G. S.

Gardiner, Allan H The nature and development of the Egyptian hieroglyphic writing. *Journal of Egyptian archæology*, vol. II, p. 61-75. London, 1915. ISIS

This evolution can be summed up as follows : Picture-writing, then ideograms. Three sorts of ideograms developed : (1) with strict pictorial meaning, whence ordinary determinatives ; (2) with extended pictorial meaning, whence generic determinatives ; (3) with phonetic meaning (phonograms) whence uniliteral or alphabetic signs, biliteral signs, triliteral signs. G. S.

Griffith, F. LI Meroitic studies. a) The numerals. *Journal of Egyptian Archæology*, vol. III, p. 22-24, 1 pl. London, 1916. ISIS

Journal of Egyptian Archæology. Published by the Egypt Exploration Fund 13, Tavistock Place, W. C. I. London, 1914, etc. ISIS

See *Isis*, t. II, p. 252. This journal contains a critical bibliography edited for Christian Egypt by STEPHEN GAZELEE, later W. E. CRUM ; for Hellenistic Egypt, F. LL. GRIFFITH ; for Græco-Roman Egypt, H. IDRIS BELL, MARCUS N. TODD, and F. LL. GRIFFITH ; for Ancient Egypt, F. LL. GRIFFITH — Vol. I to V, (1918), have been read for *Isis*, but the readers of *Isis* should refer themselves to the above mentioned bibliographies. G. S.

Knudtzon, Jorgen Alexander. Die El-Amarna-Tafeln. 2 Bde. Leipzig, HINRICHS, 1908 [1907]-1915. ISIS

The first volume (XII + 1007 p.) (1907-1909) contains the titles and translation of the Amarna letters which date of the reigns of AMENHOTEP III and AMENHOTEP IV (IKHNATON), of the XVIIth Dynasty, — that is, the end of the XVth cent. and the beginning of the XIVth. The second vol. (VIII + p. 1009 to 1614, 1909-1915) contains notes, glossaries, indexes by OTTO

WEBER, ERICH EBELING, WINCKLER and KNUDTZON. This fundamental publication is a part of the « Vorderasiatische Bibliothek, Section 7, Letters ». G. S.

Lieblein, Jens (Christiania 1827-Eidsvold 1911). *Recherches sur l'histoire et la civilisation de l'ancienne Egypte*, 3 fascicules. Christiania, CAMMERMEYER, 1910-1914. 1818

Fasc. I, 192 p., 1910 : Les XVIII premières dynasties. — Fasc. II, p. 193-384, 1911 : Les dyn. XVIII à XXVI. — Fasc. III, p. 385-476. 1914 : L'origine et la propagation de la civilisation égyptienne. Invention de l'écriture alphabétique. Les relations entre l'Egypte et l'Asie occidentale avec l'Europe. L'héritage égyptien passe aux Grecs. — L'ouvrage se termine (p. 466 etc.) par une notice biographique par WILHELM SCHENCKE. G. S.

Lucas, A. The use of Natron by the ancient Egyptians in mummification. *The Journal of Egyptian archæology*, t. I, p. 119-123. London, 1914. The use of Bitumen by the ancient Egyptians in mummification. *Ibidem*, p. 241-245. 1819

Mace, Arthur C. and Winlock, Herbert E. The tomb of Senebtisi at Lisht, XXII + 132 p., 35 pl. New York, Metropolitan Museum, 1916. 1819

Mackay, Ernest. Proportion squares on tomb walls in the Theban necropolis. *Journal of Egyptian archæology*, vol. 4, p. 74-85, illustr. 1917. 1818

« It was the custom of the ancient Egyptians, from the time of the Old Kingdom, to draw the human figure upon squares, in order to assure its correct proportions ». The author has made a study of these squares with a view to determining the canon of Egyptian figure representation as applied in the Theban necropolis during the XVIIIth Dyn. and later. G. S.

Sethe, Kurt. Von Zahlen und Zahlworten bei den alten Aegyptern und was für andere Völker und Sprachen daraus zu lernen ist. Ein Beitrag zur Geschichte von Rechenkunst und Sprache. (*Schriften d. Wissensch. Ges. in Strassburg*), VIII + 147 p., 3 pl. Strassburg, TRÜBNER, 1916. 1819

This « fundamental » publication has been extensively reviewed by BATTISCOMBE GUNN in the *Journal of Egyptian archæology*, t. III, p. 279-286. Says GUNN : « for the first time an Egyptologist of the very front rank has dealt with a part of his science not merely as a special contribution to Egyptology, but with a view to the light it throws upon similar phenomena among other peoples and languages ». It is divided as follows : Das Ziffernsystem der Aegypter. — Kardinalzahlen. — Bruchzahlen. — Ordinalzahlen. — Distributivzahlen. G. S.

Smith, G. Elliot. Egyptian mummies. *Journal of Egyptian archæology*, t. I, p. 189-196, 2 pl. London, 1914. 1819

Earliest body, as yet known, exhibiting signs suggestive of an attempt at mummification, Sakkarā, IIIrd Dyn. Earliest actual mummy, probably VIIth Dyn., found at Medūm 1892 by Prof. PETRIE, now in the Museum of the R. College of Surgeons, London. The culmination of the embalmers' art occurred during the XVIIIth and XIXth Dyn.; during the XXist Dyn. the embalmers attempted to restore the actual form of the body by packing material under the skin. From this time onwards the art rapidly deteriorated. G. S.

9. — GREECE

Dickins, Guy (d 1916). *Hellenistic sculpture*, xiv + 100 p. Oxford, CLARENDON Press, 1920. 1818

Dittenberger, Wilhelm (1840-1906). *Sylloge inscriptionum graecarum a GUILIELMO DITTENBERGER condita et aucta nunc tertium edita. Volumen primum. Documenta secundum temporum ordinem digesta usque ad pacem Naupactiam a. 217/6. 1915; vol. alterum. A pace Naupactia ad IUSTINIANUM, 1917.* Leipzig, HIRZEL. 1818

Heiberg, J. L. *Théories antiques sur l'influence morale du climat. Scientia*, t. 27, p. 453-464. Bologna, 1920. 1818

Discussion basée sur un écrit ionien du ^ve siècle av. J. C. *De l'air, de l'eau et des régions*, attribué à HIPPOCRATE mais très probablement antérieur et sur le manuel astrologique, dit *Tetrabiblos*, de PTOLÉMÉE. La comparaison de ces deux écrits prouve la décadence qu'avait subie la sagesse grecque. G. S.

Herford, Mary A. B. *A handbook of Greek vase painting*, xxii + 125 p., 11 pl. Manchester, University Press, 1919. 1818

Hess, Jean Jacques. *Καλαμίτης*, Magnetnadel. Festgabe ADOLF KÆGI. p. 189-190. Frauenfeld, 1919. 1819

Καλαμίτης, deriving from κάλαμος; Ital. calamita, Fr. calamite; Arabic, qaramit (854 A. D.). HESS would conclude from this etymology that the Chinese knowledge of the magnet was transmitted to the West by the Greeks. G. S.

Kahrstedt, Ulrich. *Die spartanische Agrarwissenschaft. Hermes*, Bd. 54, p. 279-294. Berlin, 1919. 1818

Pfeiffer, Erwin. *Studien zum antiken Sternnglauben. (Στοιχεῖα, II)* vi + 132 p. Leipzig, TEUBNER, 1916. 1818

Poulsen, Frederik. (Keeper of the Ny Carlsberg Museum, Copenhagen). *Delphi*. Translated by G. C. RICHARDS with a preface by PERCY GARDNER, xii + 338 p., 164 fig. London, GYLDENWALD, 1920. 1818

Based upon a first-hand study of archæological evidence and also upon the published volumes of the *Fouilles de Delphes*. Important because of the immense prestige of Delphi, the navel of the world, in Greek times. G. S.

Stace, W. T. *A critical history of Greek philosophy*, xiv + 386 p. London, MACMILLAN, 1920. 1818

Veazie, Walter B. The word φύσις. *Archiv für Geschichte der Philosophie*, Bd. 33, p. 1-22, Berlin, 1920. 1818

According to BURNET (*Early Greek Philosophy*) the title *περί φύσεως*, so commonly given to philosophical works of the viii and vii cent., means simply "concerning the primary substance" and the word φύσις always means that which is primary, fundamental and persistent. VEAZIE denies the correctness of these views and proposes other interpretations. G. S.

Viedebantt, Oskar. ERATOSTHENES, HIPPARCHOS, POSEIDONIOS. Ein Beitrag zur Geschichte des Erdmessungsproblems im Altertum. *Klio*. t. 14, p. 207-256. Leipzig, 1914. 1818

10. — INDIA

Avalon, Arthur (pseudonym). The Serpent Power being the Shat-chakra-nirūpana and Pādukā-Panchaka. Two works on Tantrik Yoga, translated from the Sanskrit with introduction and commentary (coloured diagrams of the Centres), xii + 292 + 184 p. London, LUZAC, 1919. 1818

Brown, Percy. Indian Painting (*The Heritage of India*). 115 p., 17 pl. Calcutta, The Association Press; London, Oxford, University Press. [n. d. 1919?] 1818

Popular account of Buddhist, Hindu and Muhammedan painting in India, with bibliography and list of main collections. (I) History (Early period, Buddhist, Medieval, Mogul, Rajput, Modern); (II) Description of Indian painting. G. S.

Coomaraswamy, Ananda. The Dance of Śiva. Fourteen Indian essays, 140 p., 27 pl. New York, The Sunwise Turn, 1918. 1818

Fourteen capital essays (some of which have already appeared in various periodicals) which anyone wishing to understand Indian thought, ought to read. These essays have a great didactic value for the Western reader: they may help him to overcome his materialistic and industrialistic tendencies. The illustrations are very interesting. G. S.

Farquhar, John Nicol. An outline of the religious literature of India (*The Religious Quest of India*), xxviii + 451 p. London, MILFORD, 1920. 1818

Garbe, Richard. Die Sāmkhya Philosophie. Eine Darstellung des indischen Rationalismus nach den Quellen. 2te umgearb. Aufl. xii + 412 p. Leipzig, HAESSEL, 1917 [1st. ed., 1894]. 1818

Ghate, V. S. Le Vedanta. Etude sur les Brahmasūtras et leur cinq commentaires, XLIV + 146 p. Tours, ARRAULT, 1918. 1818

This new study is important because it is based upon the whole evolution of Vedantism, while DEUSSEN's System (see *Isis*. t. II, 407) was based only upon BĀDARĀYANA's interpretation. G. S.

Havell, E. B. A Handbook of Indian Art. Issued to members of the India Society 1920, xvi + 222 p., 79 pl. London, JOHN MURRAY, 1920. 1818

The name of the author is a sufficient guarantee of accuracy with regard both to details and to essentials. A history of art which is not built upon a deep understanding of the souls and hearts of the artists is fundamentally wrong, however accurate the historical facts may be. Mr. HAVELL is a man of great knowledge and insight and his history is excellent, but the reader should be warned that its title is misleading. It is not a history of art, but chiefly of architecture. Sculpture is disposed of in 42 p. and painting

in 18! It would have been fairer to leave the two last sections out, and to call the book, a handbook of Indian architecture. The illustrations are abundant and very good. G. S.

Hopkins, Edward Washburn. *Epic Mythology*. 277 p. (*Grundriss der indo arischen Phil. u. Altertumskunde*, III, 1, B). Strassburg, TRÜBNER, 1915. 1813

Keith, Arthur Berriedale. *The Sāṃkhya system. A history of the Sāṃkhya philosophy (Heritage of India)* 109 p. Calcutta, Association Press, 1918. 1818

[**Lājpat Rāya**]. *The Arya Samaj. An account of its origin, doctrines and activities with a biographical sketch of the founder by LAJPAT RAI. Preface by SIDNEY WEBB*, xxvi + 305 p. London, LONGMANS, 1915. 1818

Macnicol, Nicol *Psalmes of Maratha saints. One hundred and eight hymns translated from the Marathi (Heritage of India)*, 94 p. Calcutta, Association Press, 1919. 1818

Mookerji, Radhakumud. *Local government in ancient India. With foreword by the Marquess of CREWE*, 2nd ed. rev. and enl. xxvii + 338 p. Oxford, CLARENDON Press, 1920. 1818

Oldenberg, Hermann. *Die Lehre der Upanishaden und die Anfänge des Buddhismus*, viii + 366 p. Göttingen, Vandenhoeck, 1915. 1818

Pereira, A. B. de Bragança. *O sistema das castas (Ensaio histórico-sociológico). Separata dos n.ºs 1 a 4 (1920) do Oriente Português*, 45 p. Nova Goa, 1920. 1818

Smith, Vincent A. *The Oxford history of India from the earliest times to the end of 1911 [Appendix to 1918]*, xxiv + 816 p. Oxford, CLARENDON Press, 1919. 1818

Stephen, Dorothea Jane. *Studies in early Indian thought*, 176 p. Cambridge University Press, 1918. 1818

Vallauri, Mario. *I fondamenti generali della medicina indiana. (Saggi sulla medicina indiana, I) Archivio di storia della scienza*, t. II, p. 70-88. Roma, 1921. 1818

A general survey of Indian medicine based upon a first-hand study and a comparison of the fundamental texts. The author does not attempt to compare Indian with non-Indian medical ideas. He proposes to publish later three other studies devoted respectively to Indian anatomy, pathology and therapeutics. G. H.

Walter, Howard Arnold. (d. 1918) *The Ahmadiya movement (Religious Life of India)*, 185 p. Calcutta, Association Press, 1918. 1818

11. — IRAN

Browne, Edward Granville. A history of Persian literature under Tartar dominion (A. D. 1265-1502), xvi + 586 p. Cambridge University Press, 1920. 1918

Jackson, A. V. Williams. Early Persian Poetry. From the beginnings down to the time of FIRDAUSI. With ten illustr., xxiv + 125 p. New York, MACMILLAN, 1920. 1918

A sympathetic account of Early Persian Poetry from the days of ZOROASTER to the Shāhnāma and even to the xth cent. Many original translations illustrate the text. (I) Early period (from the viith cent. B. C. to the viith cent. after Christ); (II) New awakening of Persian song after the Muham. conquest, the Tāhirid and Saffārid periods (ixth c.); (III) Rays from lost minor stars, earlier Sāmānid period (ab. 900-950 A. D.); (IV) RŪDAGĪ (or RŪDAKĪ, ab. 880-954), a herald of the dawn; (V) Snatches of minstrel song: from the later Sāmānid period to the era of MAHMŪD of Ghaznah (2nd half of x); (VI) DAQĪQĪ (d. after 975); (VII) The round table of MAHMŪD of Ghaznah: court poetry (beg. of xi); (VIII) and (IX) FIRDAUSĪ (ab. 935-1025) and the Shāhnāma. There is a list of the poets included (ab. 30) with short biographical notes, a bibliography and an index. G. S.

12. — ISLAM

Diez, Ernst. Die Kunst der islamischen Völker. (Handbuch der Kunstwissenschaft begründet v. FRITZ BURGER) 28 cm., xxii + 218 S., 5 Taf., 288 Abb. Berlin, Akademische Verlagsgesellschaft, 1915. 1918

Deals chiefly with architecture, only one short chapter (8 p.) dealing with miniature, another (15 p.) with arts and crafts. There are two introductory chapters, one devoted to preislamic art in the Near East (Seleucidian, Arsacidan, Sassanian), the other containing brief outlines of Mohammedan history and customs. G. S.

Evans, Lady [Maria Millington]. Lustre Pottery. 31 cm., xx + 148 p., 24 pl. London, METHUEN, 1920. 1918

(I) Lustre pottery of the Near East; (II) Early lustre pottery of Spain; (III) Technique of Valencian lustre pottery. Hispano-Moresque ware of the xvth-xixth centuries; (IV) Export of Spanish ware. Deruta and Gubbio lustre. Lustre pottery in England. Index. G. S.

Frank, Josef. Zur Geschichte des Astrolabs (Habilitationsschrift, Auszug) 33 p. Erlangen, 1920. 1918

See under *Astronomy*.

Horten, M. Die religiöse Gedankenwelt der gebildeten Muslime im heutigen Islam, xxiv + 184 p. Halle a. S., NIEMEYER, 1916. 1918

(A) Die Logik; (B) Die Weltanschauung: (a) Die theoretische: Gott und Welt. (I) Die Metaphysik; (II) Die Einzelwissenschaften. [(1) Gott; (2) Die Welt im allgemeinen, die Weltgesetze; (3) die Geister; (4) der Mensch; (5) die Körperwelt.] (b) Die praktische Weltanschauung: das Menschenleben, die Ethik. — Schlusswort u. Ueberblick. G. S.

Lippmann, Edmund O. von. Zucker-Monopole im Mittelalter. Die Deutsche Zuckerindustrie, Berlin [reprint of 2 columns on one page, undated].

1818

Describes two remarkable attempts to monopolize the production of sugar. The first by the caliph ALHAKIM-BI-AMR-ILLAH who reigned in Egypt from 996 to 1021 (this is the earliest attempt of this kind); the second, also in Egypt, by the Sultan BARSBĀI (1422-1438).

G. S.

Margoliouth, David Samuel. The early development of Mohammedanism. ix + 265 p. London, WILLIAMS and NORGATE, 1914.

1818

Mžik, Hans von PTOLEMAEUS und die Karten der arabischen Geographen. *Mitt. d. k. k. geogr. Gesell.*, Wien, t. LVIII, 27 p., 7 pl., 1915.

1818

Rivoira, G. T. Architettura Musulmana. Sue origini e suo sviluppo. ix + 309 p., 341 ill., 1 pl. Milano, HOEPLI, 1914.

1818

English transl., London, Milford, c. 1919.

Wiedemann, E. und Hauser, F. Ueber Vorrichtungen zum Heben von Wasser in der islamischen Welt. *Beitr. zur Gesch. d. Technik u. Industrie*, Bd. 8, S. 121-154, 37 Abb. Berlin, 1918.

1818

(1) Generalities including a list of Moslem writings on hydraulic machines; (2) Various forms of hydraulic machines; (3) Hydraulic machines after GAZARĪ, who fl. about 1200 in Dijār Bekr on the upper Tigris, and an Arabic MS. of Oxford (n° 954).

G. S.

Zwemer, Samuel Marinus. The influence of animism on Islam. An account of popular superstitions, xi + 246 p. New York, MACMILLAN, 1920 (also London, S. P. C. K.).

1818

13. — ISRAEL

(See also Bible.)

Jacobs, Joseph (1854-1916). Jewish contributions to civilization. An estimate, 334 p. Philadelphia. The Jewish publication society of America. 1919.

1818

Oesterley, W. O. E. and Box, G. H. A short survey of the literature of rabbinical and mediæval Judaism, xii + 334 p. London, Society for the promotion of Christian knowledge, 1920.

1818

Sokolov, Nahum. History of Zionism, 1600-1918. With an introduction by the Rt. Hon. A. J. BALFOUR. 2 vol., 89 portraits and illustr. London, LONGMANS, 1919.

1818

14. — JAPAN

Dautremet, Joseph. L'empire japonais et sa vie économique. 3^e éd. Paris, CHALLAMEL, 1919,

1818

- Morse, Edward Sylvester.** Japan day by day (1877-1883) with 777 illustr. from sketches in the author's diary. 2 vol. Boston, HOUGHTON, 1917. 1918

15. — MIDDLE AGES

- Endres, Jos. Anton.** Forschungen zur Geschichte der frühmittelalterlichen Philosophie (*Beitr. zur Gesch. d. Philos. des Mittelalters*, 17. Bd., H. 2 u. 3.) Münster i. W., 1915. 1918

- Hauber, A.** Planetenkinderbilder und Sternbilder. Zur Geschichte des menschlichen Glaubens und Irrens. Mit 51 grossenteils Ulmer Hdsch. entnommenen Abbildungen auf 36 Tafeln. (*Studien zur deutschen Kunstgeschichte*, 194. H.), xvi + 290 p. Strassburg, HEITZ, 1916. 1918

- Hellmann, G.** Die Wettervorhersage im ausgehenden Mittelalter (xii bis xv Jahrhundert). *Beitr. zur Gesch. d. Meteorologie*, Nr. 8, t. II, 169-229. Berlin, 1917. 1918

Divided into 3 parts : (I) *Introductions to weather-forecasting by Western writers*. HELLMANN deals chiefly with the following : xiiith cent., JOHANNES HISPALENSIS ; xiiiith, ROBERT GROSSETESTE, LEOPOLD OF Austria, GUIDO BONATTI ; xivth, ROBERT OF YORK, RICHARD OF WALLINGFORD, WILLIAM MERLE, JOHN ASHENDEN, FIRMIN DE BEAUVAL ; xvth, REGIOMONTANUS, STÖFFLER. — (II) *Sources of these introductions*. Short notices on the writers, mostly Arabic or Jewish, upon whose works mediæval theories were based. — (III). *The practice of weather-forecasting*. J. DE BLANCHIS, 1481 ; M. SCRIBANARIUS, 1482 ; J. ENGEL, 1497. Check-list of incunabula "Prognostics", 264 in all by 64 authors (32 Italians, 23 Germans and Austrians, 3 Dutchmen). The oldest is by FRANCISCUS DE GUASCONO of Venice, 1470 (earliest copy extant, 1474). G. S.

- Hoops, Johannes (editor).** Reallexikon der germanischen Altertumskunde. Unter Mitwirkung zahlreicher Fachgelehrten. 4 Bde. Strassburg, TRÜBNER, 1911-1919. 1918

A mediæval encyclopedia of fundamental value, including 2023 articles contributed by 84 scholars. It is complete, but a fifth volume containing addenda and a general index is being prepared. Among the contributors we note *ex. gr.* the late BJÖRNBO, FRANZ BOLL, KARL SUDHOFF, PAUL VINOGRADOFF. G. S.

- Maunder, A. S. D.** The date and place of writing of the Slavonic Book of ENOCH. *The Observatory*, vol. 41, p. 309-316, 1918. 1918

The book includes a description of the ten heavens and an account of the Christian ecclesiastical calendar. It is not as old as the eleventh century. J. L. E. D.

- O'Brien, George.** An essay on mediæval economic teaching. London, LONGMANS, 1920. 1918

- Renard, Georges.** Guilds in the Middle Ages. Transl. by DOROTHY TERRY and ed. with an introduction by G. D. H. COLE, xxv + 140 p. London, BELI, 1919. 1918

Schöffler, Herbert. Beiträge zur mittelenglischen Medizinliteratur, xv + 308 p. Halle a. S., NIEMEYER, 1919. 1518

Singer, Dorothea Waley. Survey of medical manuscripts in the British Isles dating from before the sixteenth century. *Proceedings of the R. Soc. of Med.*, 1919, vol. xiii, p. 96-107. London. 1518

Completes the note published in *Isis*, t. III, p. 271-274, giving the description of 34 typical medical MSS. and statistical information. The catalogue refers to some 30,000 MSS. (counting all duplicates) of which half are medical or quasi-medical. There survive in the British Isles some 1900 texts on general medicine, 225 on anatomy; 194 on surgery; 42 on the pulse, 274 on uroscopy. 63 on the eye; 10 on diagnosis by blood inspection; 600 on herbals and simples; 2500 on recipes; 669 bestiaries; 600 magical texts and charms; 953 on alchemy; 183 lapidaries; 114 on physiognomy and cheiromancy; 41 on melothesia; 624 on the four complexions; 234 on phlebotomy; 168 on fevers; 144 on diet; 90 on pestilence; 176 on gynaecology; 106 on fermentation and generation; 72 on regimen and health of children; 214 on other regimens; 220 on hospitals. The chronological distribution is as follows (the Roman numerals designate centuries, the Arabic, numbers of MSS.): viii, 6; ix, 19; x, 38; xi, 98; xii, 175; xiii, 1058; xiv, 2251; xv, 4931. G. S.

Singer, Dorothea Waley. Hand-list of scientific MSS. in the British Isles dating from before the sixteenth century, 12 p. London, ALEX. MORING Ltd. 1919. 1515

A plea for the study of mediæval science and an outline of the work undertaken by the author; see a similar outline in *Isis*, t. III, p. 271-274, 1920. G. S.

Sudhoff, Karl. Beiträge zur Geschichte der Chirurgie im Mittelalter. Graphische und textliche Untersuchungen in mittelalterlichen Handschriften. *Studien zur Geschichte der Medizin*, Heft 10, 11, 12). Erster Teil, x + 224 p., 65 pl., 1914; xxxvi + 685 p., 29 pl., 1918. Leipzig, BARTH. 1518

It is not the editor's fault if this monumental publication has not yet been reviewed in *Isis*. However because of its very importance, it will be enough for the present to mention it and to say that no one can henceforth undertake to study mediæval surgery (or medicine) without reference to it. It is an amazing collection of original texts and illustrations; we cannot look it over without feeling deeply grateful to the great old man who gave it to us. This wealth of new material would make it necessary to rewrite the mediæval section of GURLT's history (1898). The documents are classified as follows: (1) Operationsbilder; (2) Lehr- und Merkschemata für die Beurteilung der Schwere von Verletzungen, Kauterienanwendung, Schröpfen und Aderlass; (vol. 2): (3) Abbildungen von Instrumenten; (4) Lateinische chirurgische Texte des Mittelalters aus Italien und Südfrankreich; (5) Chirurgische Texte aus Deutschland, grösstenteils in deutscher Sprache, Verzeichnis der benutzten Hdsch. Namen, Sach und Wortregister. G. S.

Turberville, Arthur Stanley. Mediæval heresy and the inquisition, vii + 264 p. London, CROSBY, 1920. 1518

Wedel, Theodore Otto. The mediæval attitude toward astrology, particularly in England. (*Yale studies in English*, LX), 168 p. New Haven, YALE University Press, 1920. 1519

The author's original purpose was to interpret references to astrology in mediæval English literature, but he was irresistibly led to extend his field of research and to trace the development of astrology from AUGUSTINE to the xvth cent. His work is subdivided as follows: (1) Ancient astrology (chiefly based on BOUCHÉ-LECLERQ); (2) Astrology in the early mediæval centuries; (3) Astrology in old English literature; (4) Arabian astrology; (5) Mediæval acceptance of astrology; (6) Astrologers in mediæval England; (7) Astrology in the mediæval romances; (8) Astrology in middle English literature; (9) Astrology in GOWER and CHAUCER. Bibliography and Index. The author seems to have covered the ground thoroughly. It is a pity however that he did not know FR. BOIL'S excellent little book *Sternnglaube u. Sterndeutung*. Leipzig, 1919 (cfr. *Isis*, t. III, p. 482).
G. S.

Wells, John Edwin. A manual of the writings in Middle English, 1050-1400, xv + 941 p. New Haven. YALE University Press, 1916; First supplement, Additions and modifications to September 1918, p. 947-1037. 1919. 1818

Williams, Mary Wilhelmine. Social Scandinavia in the Viking age, xiv + 451 p. New York, MACMILLAN, 1920. 1818

16. — ROME

Besnier, Maurice. L'interdiction du travail des mines en Italie sous la République. *Revue archéologique*, t. X, p. 31-50. Paris, 1919. 1818

Apropos of the legal obstacles to the mining industry, dating chiefly of the second century B. C. which were due to the deep aversion of the Romans to mining.
G. S.

Cagnat, René et Chapot, V. Manuel d'archéologie romaine, t. I. Les monuments. Décoration des monuments. Sculpture, xxvi + 735 p., 371 fig. Paris, PICARD, 1916. 1818

Il suffira d'indiquer la table des matières de cette excellente encyclopédie, fruit d'une très longue expérience — I. Les monuments: (1) Matériaux de construction; (2) Utilisation des différents matériaux pour la construction et la décoration des édifices; (3) Routes, ponts et ports; (4) Villes, murailles et portes; (5) Citernes, aqueducs, fontaines et égouts; (6) Forum et ses monuments; (7) Monuments religieux; (8) Salles de spectacle; (9) Etablissements de bains; (10) Marchés, greniers, magasins, celliers; (11) Salles de réunion, bibliothèques; (12) Camps et défences de frontières; (13) Monuments honorifiques; (14) Maisons de ville; (15) Exploitations agricoles, maisons de campagne; (16) Monuments funéraires. — II. Décoration des monuments: Première partie. La Sculpture: (1) Généralités, technique; (2) Divinités; (3) Portrait. Empereurs et impératrices; (4) Portrait. Les particuliers; (5) Sujets de genre en ronde bosse; (6) Reliefs décoratifs; (7) Bas-reliefs à sujets religieux; (8) Reliefs funéraires; (9) Reliefs à sujets historiques et militaires; (10) Bas-reliefs à sujets de genre; (11) Sujets de lampe; (12) Reliefs de stuc; (13) Reliefs de céramique peinte. G. S.

Gummerus, Herman. Die römische Industrie. Wirtschaftsgeschichtliche Untersuchungen. I. Das Goldschmied- und Juweliergewerbe. *Klio*, t. XIV, p. 129-189. Leipzig, 1914; t. XV, p. 256-302, 1918. 1818

Mentz, Arthur. Beiträge zur Geschichte der römischen Stenographie. *Hermes*, 51. Bd., p. 189-210. Berlin, 1916. 1818

(I) ISIDOR und die römische Stenographie; (II) Die christlichen Bestandteile der *Commentarii Notarum Tironianarum*; (III) Die erdkundlichen Namen in den *Commentarii Notarum Tironianarum* III, 1; (IV) Die Anlage von SENECA'S Verzeichnis Tironischer Noten. G. S.

Miller, Konrad. *Itineraria Romana. Römische Reisewege an der Hand der Tabula Peutingeriana dargestellt*, LXXV + 960 col. + 961-992 p., 317 illustr. Stuttgart, STRECKER, 1916. 1818

Mooney, William West. *Travel among the ancient Romans*, 178 p., 26 illustr., 5 maps. Boston, BADGER, [1920]. 1818

Miscellaneous. Travel on land. Travel on water. Lodging. — A semi-popular account based partly on the sources, partly on other manuals. The author does not profess to present anything new on the subject, but his account is clear and gives one a vivid idea of Roman travel. G. S.

Oswald, Felix and Pryce, T. Davies. *An introduction to the study of Terra Sigillata, treated from a chronological standpoint*. XII + 286 p., 85 pl. London, LONGMANS, 1920. 1818

Sandys, Sir John Edwin. *Latin epigraphy. An introduction to the study of Latin inscriptions*, xxiv + 324 p. Cambridge University Press, 1919. 1818

PART III.

Systematic classification.

Containing only the materials which could not be included in the two previous parts: centuriat and historical. The topics are classified in alphabetic order.

2. — ANTHROPOLOGY (human and comparative)

Boule, Marcellin. *Les hommes fossiles. Éléments de paléontologie humaine*, 492 p., 239 fig. Paris. MASSON, 1921. 1818

Voir L. JOLEAUD, *Revue générale des sciences*, t. 32, p. 69-74, 1921.

Hrdlicka, Ales. *The Races of Russia (with 1 map)*. Smithsonian Miscellaneous collections, vol. 69, no. 11, 21 p. Washington, 1919. 1818

Russia is eminently a Slav country. The same can be said of Siberia and in large measure even of the Caucasus. In Central Asia the Russian element is still considerably exceeded by the Turco-Tartars. The Russian Slavs count to day over one hundred millions and they are increasing yearly by 1,700,000. G. S.

Keane, Augustus Henry (1833-1912). *Man. Past and Present*. Revised and largely rewritten by A. HINGSTON QUIGGIN and A. C. HADDON, xi + 582 p., 16 pl. Cambridge University Press, 1920 [1st ed., 1899]. 1818

3. — ARCHÆOLOGY (museums and collections)

British Museum. *How to observe in archæology. Suggestions for travellers in the Near East and Middle East*, 103 p. London, 1920. 1818

Dottin, Georges (Prof. univ. Rennes. Manuel pour servir à l'étude de l'antiquité celtique, 2^e ed. revue et augmentée, xvi + 524 p. Paris, CHAMPION, 1915. 1818

Le plan et la méthode de cet ouvrage excellent sont les mêmes que ceux de la 1^{re} éd. de 1906. Il est bon de dire que le livre de DOTTIN ne fait aucunement double emploi avec le Manuel du regretté DÉCHELETTE. En voici le plan : (1) Sources et méthode; (2) Langue; (3) Personnes et coutumes; (4) Etat; (5) Religion; (6) Bardes, vates, druides; (7) Empire celtique. Index très copieux. G. S.

Holmes, William Henry. Handbook of aboriginal American antiquities. Part I. Introductory. The lithic industries. (*Bureau of American ethnology*, Bull. 60), xvii + 380 p., 223 fig. Washington, Government printing office, 1919. 1818

The first 154 pages deal with generalities, the rest with the lithic industries. Among the problems dealt with in the introduction, I would quote: race and culture origins, intercontinental communication, migration, culture development and mutation, chronology, characterization areas, classification of antiquities. Let us hope that HOLMES will be able to complete rapidly this precious encyclopædia. G. S.

Joyce, Thomas Athol. Mexican archæology, an introduction to the archæology of the Mexican and Mayan civilizations of pre-Spanish America. New York. PUTNAM, 1914. 1818

Joyce, Thomas Athol. Central American and West Indian archæology; an introduction to the archæology of the states of Nicaragua, Costa Rica, Panama and the West Indies. New York, PUTNAM, 1916. 1818

4. — ART. ART AND SCIENCE. ICONOGRAPHY

Combarieu, Jules. Histoire de la musique des origines au début du xx^e siècle, 3 vol. Paris, COLIN, 1913-1919. 1818

Filow, Bogdan D. Early Bulgarian art, viii + 86 p., 58 pl., 72 ill. Berne, HAUPT, 1919. 1818

Richter, Gisela M. A. Catalogue of engraved gems of the classical style, LXXIV + 232 p. New York, Metropolitan Museum, 1920. 1818

Strzygowski, Josef. Altai-Iran und Völkerwanderung Ziergeschichte. liche Untersuchungen über den Eintritt der Wander- und Nordvölker in die Triebhäuser geistigen Lebens. Anknüpfend an einen Schatzfund in Albanien. Mit 229 Abb. und 10 Lichtdrucktafeln, 4^e, xii + 319 S. Leipzig, HINRICHS, 1917. 1818

This study of Medieval art utilizes a material of bewildering complexity, largely Oriental. It originated in the study of the Albanian treasure found in 1902, the greatest part of which was bought by the late J. PIERPONT MORGAN and is now in New York. (cfr. *Isis*, t. IV, p. 174.) G. S.

6. — ASTRONOMY, GEODESY, METEOROLOGY AND TERRESTRIAL PHYSICS

Ambronn, L. Beiträge zur Geschichte der Feinmechanik. *Beiträge zur Gesch. d. Technik und Industrie*. Bd. 9, S. 1-40, 29 Abb. Berlin, 1919. 1818

A history of astronomical instruments with bibliography. G. S.

Berget, Alphonse. Où en est la météorologie? 302. Paris, GAUTHIER-VILLARS, 1920. 1818

Frank, Josef. Zur Geschichte des Astrolabs. (Habilitationsschrift, Auszug), 33 p. Erlangen, 1920. 1818

This is only an extract of a more elaborate work on the Astrolabe to appear later. The author describes briefly this instrument and some of his less known varieties and explains the construction and applications of the latter. These explanations are derived chiefly from a book of AL BÎRÛNÎ, as translated by E. WIEDEMANN. We look forward to the publication of FRANK's complète work on the Astrolabe. G. S.

Hellmann, G. Beiträge zur Geschichte der Meteorologie, Nr. 1-5. (*Veröff. des kgl. preuss. meteor. Instituts*, Nr. 273) 4° 148 S. Berlin, BEHREND, 1914. *Idem*, 2. Band, Nr. 6-10 (*Ibidem*, Nr. 296) VI+340 S. mit 3 Tafeln u. 1 Tab. Berlin, 1917. 1818

The contents of these two volumes are analyzed in the present tenth critical bibliography, the title and analysis of each essay being placed where it belongs. G. S.

Hellmann, G. Die theologisch-meteorologische Literatur. *Beitr. zur Gesch. d. Meteorologie*, Nr. 4, p. 113-138. Berlin, 1914. 1818

Elaborate description of a selected collection of theological books dealing mainly with meteorological facts. They are classified in 3 groups: (I) *Sermons* apropos of floods, storms, etc. As every catastrophe was the occasion of many such sermons, only a relatively small number could be quoted. They date from 1562 to 1911; (II) *Theol.-meteorol. treatises*, wherein meteorological facts are treated more systematically and at greater length. The oldest quoted is one by A. MOIBANUS, 1536 with a preface by LUTHER. It contains a description of a storm in Oels, Silesia, Sept. 1, 1535. Many of the later treatises were inspired by WILLIAM DERHAM's *Physico-Theology*, 1713. The latest exhibit is dated 1752; (III) *Prayerbooks* for special use during storms, etc.: a) *evangelical*, from 1607 to c. 1800; b) *catholic*, from 1667 to 1902. — Many of the earliest of these books are important from the historico-meteorol. point of view, because of the descriptions they contain. G. S.

Hellmann, G. Entwicklungsgeschichte des meteorologischen Lehrbuches. *Beitr. zur. Gesch. d. Meteor.* Nr. 6, t. II, p. 3-133, Berlin, 1917. 1818

A critical bibliography divided in two parts: (I) ARISTOTLE's meteorology. A critical list of printed editions, translations and commentaries from 1474 to 1901 including 37 incunabula, 98 xvith, 26 xvith, 3 xvith and 9 xixth cent. items. FOBES' critical edition (1919) could of course not be included

(see *Isis*, t. III, p. 278); (II) A critical list of meteorological textbooks from 1500 to 1914, with an introductory commentary. It mentions: 1 incun., 56 xvith, 61 xvith, 35 xvith cent. items; 79 published in the first half of last century and 346 in the period 1851-1914. G. S.

Hellmann, G. Die ältesten Untersuchungen über Windhosen. *Beitr. zur Gesch. d. Meteorologie*, t. 11, p. 329-334. Berlin, 1917. 1818

There are many references to water- and windspouts in ancient literature, but the oldest general descriptions date of the xvith cent.: OLAUS MAGNUS in his *Historia de gentibus septentrionalibus*, Romae 1558 and LUIS DE CAMÕES in the *Lusiadas*, V, 18-23. The first scientific observations were made by the R. P. FRANÇOIS LAMY, (1636-1711) of the congregation of SAINT MAUR in 1680 (colonne de nuë) and publ. anonymously in 1689; later observations were made by G. MONTANARI of Padova, 1686, and publ. posthumously in 1694. First representation of a "twister", in *Journal des Voyages de Monconys*, 1665. First map of "the passage of a hurricane" by R. BUDGEN, London 1730. G. S.

Kempf, Nikolaus. Die Entwicklung der Theorien über den Höhenrauch. *Archiv für Gesch. d. Naturw.*, t. 7, p. 141 162 (*Schluss*). Bibliographie, 1552-1912. 1819

Moreux, Th. (abbé). Où en est l'astronomie?, 293 p., 62 fig. Paris. GAUTHIER-VILLARS, 1921. 1818

8. — BIOLOGY

Chun, Carl (1852-1914) und **Johannsen, W.** (editors). Allgemeine Biologie (*Die Kultur der Gegenwart*, 3. Teil, 4. Abteilung, 1. Bd.), XII + 691 p., 115 fig. Leipzig, TEUBNER, 1915. 1819

The historical introduction, from LINNÉ to DARWIN, is contributed by EM. RADL (29 p.). G. S.

East, E.M. and Jones, D. F. Inbreeding and outbreeding. Their genetic and sociological significance (*Monographs on experimental biology*), 285 p. Philadelphia, LIPPINCOTT, 1919. 1816

Janet, Charles. Considérations sur l'être vivant. Première partie: Résumé préliminaire de la constitution de l'orthobionte, 80 p., 1 pl. Beauvais, A. DUMONTIER, 1920. 1818

Lillie, Frank Rattray. Problems of fertilization, XII + 278 p. Chicago, University Press, 1919. 1815

Mac Farlane, John Muirhead. The causes and course of organic evolution. A study in bioenergetics, 875 p. New York, MACMILLAN, 1918. 1818

MacLeod, Julius (1857-). The quantitative method in biology, XII + 228 p. (Public. of the University of Manchester). London, LONGMANS, 1919. 1818

- Matisse, Georges.** Action de la chaleur et du froid sur l'activité des êtres vivants, 556 p. Paris, LAROSE, 1919. 1818

- Haeckel, Ernst** (1834-1919). Fünfzig Jahre Stammesgeschichte. Historisch-kritische Studien über die Resultate der Phylogenie, 70 p. Jena, FISCHER, 1916. 1818

- Nägler, Kurt.** Am Urquell des Lebens. Die Entdeckung der einzelligen Lebewesen von LEEUWENHOEK bis EHRENBURG, 116 p., 38 fig. (Voigtländers Quellenbücher). Leipzig, 1918 (?). 1818

9. — BOTANY

(Agronomy, Phytopathology, Palæobotany.)

- Béguinot, Augusto** La Botanica. Guide « ICS », Profili bibliografici de « L'Italia che scrive », 116 p. Roma, Istituto per la propaganda della cultura italiana, 1920. [3 L. 50] 1818

As in the previous guide of the same collection, devoted to Geography (*Isis*, t. III, p. 360), the bibliography proper is preceded by an introductory text (43 p.) which offers a short synthesis of Italian efforts in botany. The introduction is subdivided as follows : (I) History from 1801 to 1870. — (II) Schools and tendencies since 1870. — (III) History since 1870 : (1) anat., physiol. and biology ; (2) systemat. bot., monographs ; (3) floristics, cryptogamy ; (4) phytogeography, origin of floras ; (5) origin of species, evolution ; (6) applied bot. ; (7) histor. and bibliogr. studies. — (IV) Organization of bot., collective undertakings. — Excellent compendium. G. S.

- Maurizio, Adam.** Die Getreidenahrung im Wandel der Zeiten, 257 p., 53 illustr. Zürich, FÜSSL, 1916. 1818

10. — CHEMISTRY, PHYSICO-CHEMISTRY

- Gunther, R. T.** Early Science in Oxford. Part I. Chemistry, vi + 91 p. Oxford Science Laboratories, 1920. 1818

Title quoted from Sir EDWARD THORPE's elaborate review in *Nature*, vol. 107, p. 13-15, 1921. G. S.

- Herz, Walter G.** Grundzüge der Geschichte der Chemie. Richtlinien einer Entwicklungsgeschichte der allgemeinen Ansichten in der Chemie, 142 p. Stuttgart, ENKE, 1916. 1818

- Meyer, Ernst von** (1847-1916). Geschichte der Chemie von den ältesten Zeiten bis zur Gegenwart. Zugleich Einführung in das Studium der Chemie. 4te verbesserte und vermehrte Auflage, xiv + 616 p. Leipzig, VERT, 1914. 1818

The first ed. of this capital textbook appeared in 1889, the third in 1905 (end of 1904) ; the English transl. by GEORGE MCGOWAN, London, MACMILLAN appeared first in 1891 ; second and third ed. following closely the second and third German ed., appeared in 1898 and 1906. — In this fourth ed. the author has availed himself of the results of the investigations carried on by LIPPMANN, GUARESCHI, WIEDEMANN, KAHLBAUM, STRUNZ, etc. He was not able to use LOEWENFELD's Contributions, Manchester 1913. G. S.

Moore, F. Jewett. A history of chemistry, xiv + 292 p., illustr. New York. MCGRAW-HILL, 1918. 1918

Outgrowth of a series of talks which the author has for several years given to his students at the Massachusetts Institute of Technology. Many portraits and illustrations; short bibliogr. notes at the end of each chapter. G. S.

Ostwald, Wilhelm. Die chemische Literatur und die Organisation der Wissenschaft, iv + 120 p. Leipzig, Fock, 1919. 1919

11. — ECONOMICS

(Economic doctrines and theories, Commerce, Transportation and Communications.)

Bellet, Daniel (1864-1917). L'évolution de l'industrie, 346 p. Paris, FLAMMARION, 1914. 1915

Chapin, Francis Stuart. A historical introduction to social economy, xi + 316 p. New York, CENTURY, 1917. 1919

12. — EDUCATION

(Methods, Colleges, Universities.)

Bologna. L'Università di Bologna nel passato e nel presente. A cura di un comitato di professori della stessa università, xvi + 198 p., ill. Bologna, ZANICHELLI, 1919. 1919

Kenyon, Frederic George Education Secondary and University. A report of conferences between the Council for Humanistic Studies and the Conjoint Board of Scientific Societies, 47 p. London, MURRAY, 1919. 1919

13. — ETHNOLOGY

(Primitive and popular science.)

Bellucci, Giuseppe. I chiodi nell' etnografia antica e contemporanea. 266 p., 64 ill. Perugia, Un. tipog. coop., 1919. 1919

Cope, Leona. Calendars of the Indian North of Mexico. *Publications in American archaeology and ethnology*, vol. 16, p. 119-176. Berkeley, University of California Press, 1919. 1919

Cushing, Frank Hamilton. Zuñi breadstuff. (Indian notes and monographs, vol. viii), 674 p., illustr. New York, Museum of the American Indian, 1920. 1919

The author (b. in Northeast, Pennsylvania 1857, d. 1900) a born ethnologist and a man of genius, lived as an adopted member of the Zuñi tribe from 1879 to 1884, indeed he became second chief of the tribe, the Head Priest of the Bow, wearing native costume, eating native food and participating in all native occupations and pastimes. The studies here reprinted from *The Millstone* of Indianapolis, 1884-1885 (an extinct trade magazine), are thus of considerable importance. Biographical notes by Major JAMES JOHN WESLEY POWELL are reprinted in the Foreword from the 21st. Annual Report of the Bureau of American Ethnology.

G. S.

Gilmore, Melvin R. Uses of plants by the Indians of the Missouri river region. *Thirty-third annual report of the Bureau of American ethnology*, p. 43-154, 33 pl. 1919. 1819

Quoted from O. A. STEVENS' elaborate review in *Science*, vol. 52, p. 99-101, 1920. G. S.

Hahn, Eduard. Von der Hacke zum Pflug (*Wissenschaft und Bildung*, 127). 114 S. Leipzig, QUELLE und MEYER, 1914. 1818

A popular account of a great subject — the origins of husbandry — by a master who has devoted twenty five years of his life to it. HAHN's theory is entirely opposed to the old (*i. e.* XVIIIth cent.) theory of the three stages of culture: the hunter, the shepherd, the husbandman. This theory was accepted because of an undervaluation of woman's activities, specialized from the beginning in husbandry. HAHN also insists upon the religious origins of agriculture: while the material labour was being done by woman, it was man's business to attend to the magical side. G. S.

Lowie, Robert H. Primitive society, viii + 463 p. New York, BONI and LIVERIGHT, 1920. 1818

Marett, R. R. Psychology and Folk-lore, ix + 275 p. London, METHUEN, 1920. 1818

Routledge, Mrs. Scoresby. The mystery of Easter island. The story of an expedition, xxi + 404 p. London, printed for the author by HAZELL, [1919]. 1818

Smith, Grafton Elliot. The evolution of the dragon, xx + 234 p. Manchester, University Press, 1919. 1818

Stübe, R. Zur Ursprungsgeschichte der alkoholischen Getränke. *Beitr. zur Gesch. d. Technik u. Industrie*, t. VIII, p. 56-63. Berlin, 1918. 1818

14. — GEOGRAPHY

Günther, Sigmund Das Zeitalter der Entdeckungen. Vierte Auflage, 106 p. (*Aus Natur und Geisteswelt*, 26). Leipzig, TEUBNER, 1919. 1818

This fourth ed. of GÜNTHER's well known history of geographical discoveries has been brought up-to-date, at least as far as German publications are concerned. This being a popular account, there are no footnotes but only a short bibliography at the end. (I) Antiquity and Middle Ages (p. 5-20); (II) The Portuguese in Africa and India (p. 20-38); (III) COLUMBUS and the discovery of the New World (p. 39-52); (IV) The first circumnavigation and the exploration of the Pacific Ocean (p. 52-62); (V) Discoveries and conquests of the Spaniards and Portuguese in America (p. 62-86); (VI) Exploration by the French and the Germans. Short index. G. S.

Langenmeier, Theodor. Lexikon zur alten Geographie des süd-östlichen Aequatorialafrika, vii + 100 p., 50 ill. (*Abh. des Hamburgischen Kolonialinstituts*, t. XXXIX). Hamburg, FRIEDERICHSEN, 1918. 1818

Sheppard, T. The evolution of topographical and geological maps. *British Association for the Advancement of Science, Cardiff meeting, 1920.* Reprint, 14 p. 1915

Deals only with English maps, but contains much first-hand information. The author has compiled a still unpublished *Catalogue of British Geological Maps*, at the request of the Geological Society of London. — He is specially interested in the old county maps and road books. The study of the old "soil" maps and surveys leads him then naturally to that of the geological maps, especially those of "Strata" SMITH. G. S.

Wolkenhauer, W. Deutschland im Kartenbilde. Uebersicht der ältesten und einer Auswahl neuerer und neuesten Karten von (Gesamt-) Deutschland. *Deutsche Geographische Blätter*, t. XXXIX, p. 19-32. Bremen, 1919. 1818

The oldest maps of Germany is the Ebstorf map of c. 1290. Then follow: 1491, NIC. OF CUSA; 1492, ERHARD ETZLAUB; 1493, HIER. MÜNZER; c. 1500, G. A. VAVASSOR, etc. This list of maps with critical notes is subdivided in 5 parts: a) the oldest maps to MERCATOR, 1585; b) from MERCATOR to HOMANN (1589-1700); c) since HOMANN (1705-1805); d) the newer maps since REYMANN (1805-1871); e) the maps of the new German empire (1874-1916). — This paper is dedicated by the author to the memory of his son AUGUST, who had begun himself a study of the same subject and died on the battlefield in France on Febr. 25, 1915. G. S.

15. — GEOLOGY, MINERALOGY, PALÆONTOLOGY, MINING

(for palæobotany and palæozoology see respectively botany and zoology).

Crivelli, Epaminonda. Le vicende dei nomi dei metalli. *Archivio di storia della scienza*, t. II, p. 1-45. Roma, 1921. 1818

Generalities, Iron, Tin, Copper, Gold, Silver, Platinum, Lead, Antimony. An elaborate study of the metals known in ancient times, introduced by the startling statement: "La metallurgia si presenta completa all' alba dei tempi storici". G. S.

Maedje, Carl Max. Ursprung der ersten Metalle, der See- und Sumpferzverhüttung, der Bergwerkindustrie und ihrer ältesten Organisation in Schweden. Eine prähistorisch- und historischökonomische Abhandlung. XIII + 166 p. Jena, FISCHER, 1916. 1818

Merriam, John C. The beginnings of human history read from the geological record: the emergence of man. *Scientific monthly*, vol. X, p. 321-442, 425-437, illustr. New York, 1920. 1818

Part two, Geological history of man. Delivered before the National Academy of Sciences in April 1910, as the sixth series of lectures on the WILLIAM ELLERY HALE Foundation. G. S.

Meunier, Stanislas. Les glaciers et les montagnes. (*Bibliothèque de philosophie scientifique*), 262 p. Paris, FLAMMARION, 1920. 1818

Perrier, Edmond. La terre avant l'histoire. (Les origines de la vie et de l'homme) XXIII + 415 p. (200 × 140). Paris, La Renaissance du Livre, 1920. [15 fr.] 1818

Premier volume d'une vaste collection de synthèse historique « L'Evolution de l'humanité » dirigée par HENRI BERR, et qui ne doit pas comprendre moins de cent volumes. — Le présent travail est divisé en trois parties : la formation de la terre ; les formes primitives de la vie ; vers la forme humaine. — Bibliographie non seulement très pauvre, mais unilatérale.

L. G.

Sapper, Karl. Katalog der geschichtlichen Vulkanausbrücke. (*Schriften der wissensch. Ges. in Strassburg*), 27. Heft, xi + 358 p. Strassburg, TRÜBNER, 1917.

1813

A publication of fundamental importance made from the point of view of the geologist rather than of the historian. Therefore the general order is geographical, not chronological. Yet to the historian too, this very carefully compiled list will be very useful. It is followed by a series of notes and statistics of general vulcanological interest.

G. S.

Treptow, E. Der älteste Bergbau und seine Hilfsmittel. *Beitr. zur Gesch. d. Technik u. Industrie*, Bd. 8, S. 155-191, 50 Abb. Berlin, 1918.

1818

History of mining in prehistoric and ancient times, also by primitive people and in the Far East. Very elaborate and interesting.

G. S.

Wichmann, Arthur. Die Erdbeben des indischen Archipels bis zum Jahre 1857. *Verhandelingen der Kon. Akad. van Wetenschappen te Amsterdam*, 2^{de} sectie, deel XX, n^o 4, 193 blz. Amsterdam, 1918.

1813

A catalogue of earthquakes in the East Indies from 88 A. D. to 1857, with indications of the sources of reference. The dates are given whenever possible both in Christian and Javanese style. For ex. the first date is 88 A. D. = Çaka 10. Then follow : 134, 296, 416, 444, 1192, 1200, 1242, 1254, 1282, 1296 ; 7 in the xivth cent., 6 in the xvth, 12 in the xvith, etc.

G. S.

16. — HISTORY OF CIVILIZATION

General history. Historical methods. Biography and Chronology.

Abbott, Wilbur Cortez (*Prof. HARVARD*). The expansion of Europe. A history of the foundations of the modern world, 2 vol. New York, HOLT, 1918.

1818

Bury, John Bagnell. The idea of progress. An inquiry into its origin and growth, xv + 377 p. London, MACMILLAN, 1920.

1918

Cotterill, H. B. Italy from DANTE to TASSO (1300-1600). Its political history as viewed from the standpoints of the chief cities with descriptions of important episodes and personalities and of the art and literature of the three centuries, xxviii + 617 p., with many maps and illustrations. London, HARRAP, 1919.

1818

A useful summary, century by century of Italian life, letters, art ; followed by a series of lists and genealogical tables.

G. S.

Gilfillan, S. C. The coldward course of progress. *Political science quarterly*, t. XXXV, p. 393-410, New York, 1920.

1818

The thesis of the author is that civilization has tended to move « coldward » while advancing and « warmward » when declining.

G. S.

Harnack, Adolf von. Ueber die Sicherheit und die Grenzen geschichtlicher Erkenntnis. Vortrag. 23 p. München, OLDENBURG, 1917. 1818

Huntington, Ellsworth. World power and evolution, 287 p. New Haven, Yale University Press, 1919. 1815

Macdonald, George. The evolution of coinage, viii + 148 p., 8 pl. Cambridge University Press, 1916. 1818

Petrie, W. M. Flinders. Some sources of human history, 128 p., illustr. London, Society for the promotion of Christian Knowledge, 1919. 1818

Wells, Herbert George (1866-). The outline of history. Being a plain history of life and mankind, 2 vol., illustr. London, NEWNES, 1920. 1818

A very useful undertaking, similar to that attempted previously by ELISÉE RECLUS and others. Such books have done more to diffuse knowledge and understanding of the past than all the universities of the world. One cannot be too thankful to their authors. G. S.

17. — LANGUAGE AND LITERATURE

Boas, F. (and others). Phonetic transcription of Indian languages. Report of Committee of American anthropological association. Smithsonian miscellaneous collections, vol. 66, no 6, 15 p., 1 table. Washington, 1916. 1818

Results of a cooperative study of the subject by F. BOAS, P. E. GODDARD, E. SAPIR, A. L. KROEBER. Interesting also for those concerned with the general problem of transliteration or any one of its applications. A table reproduces the classification of 36 vowels based on H. SWEET. G. S.

Jespersen, Otto. The classification of languages. A contribution to the history of linguistic science. *Scientia*, t. XXVIII, p. 109-120, Bologna, 1920. 1818

Traces the history of the morphological classification of languages into three groups: isolating, agglutinating and flexional languages. FRIED. v. SCHLEGEL, 1808; A. W. v. SCHLEGEL, 1818; FRANZ BOPP, 1820; WILH. v. HUMBOLDT, 1822; A. F. POTT; AUGUST SCHLEICHER, 1848, etc. JESPERSEN's conclusion is that the tripartition is insufficient to classify languages comprehensively, for their structural diversities are far too great. Languages seem to have evolved at all times in the same way as they do now, — from greater complication and irregularity towards greater ease and simplicity and regularity, or from chaos to cosmos. G. S.

Marouzeau, J. La linguistique ou science du langage, 190 p. Paris, GEUTHNER, 1921. [7 fr. 50] 1818

Excellente introduction à la linguistique, très claire, très sûre et très complète, écrite en une langue fort simple, sans aucun pédantisme. Chaque chapitre est précédé d'une courte bibliographie purement française. L'auteur indique successivement le but et le contenu des diverses branches de la linguistique dans l'ordre suivant: phonétique, étude du vocabulaire, morphologie, sémantique, syntaxe, stylistique, grammaire descriptive,

grammaire historique, grammaire comparée, grammaire générale, et termine par quelques indications sur les sciences auxiliaires et sur l'histoire de la linguistique. G. S.

18. — LOGIC AND THEORY OF KNOWLEDGE

Bloch, Ernst. Ueber Wirklichkeit und Wahrheit. Ein Beitrag zur entwicklungsgeschichtlichen Begründung der Erkenntnistheorie. *Annalen der Naturphilosophie*, 14 Bd., p. 54-82, Leipzig, 1919. 1813

Burali-Forti, Cesare. Logica matematica, 2a ediz. intieramente rifatta, xxxii + 483 p. Milano, HOEPLI, 1919. 1813

Lewis, Clarence Irving. A survey of symbolic logic. vi + 406 p. Berkeley, University of California Press, 1918. 1813

19. — MATHEMATICS

Ahrens, Wilhelm. Mathematische Unterhaltungen und Spiele. 2te verm. u. verbess. Auflage, 2 Bd., x + 455 p. Leipzig, TEUBNER, 1910-1918. [1st ed., 1901]. 1818

Archibald, R. C. EULER integrals and EULER's spiral, sometimes called FRESNEL integrals and the Clothoïde or CORNU's spiral. *American mathematical monthly*, t. XXV, p. 276-282, 1918. 1813

Archibald, Raymond Clare. Notes on the logarithmic spiral, golden section and the FIBONACCI series. Reprinted from JAY HAMBIDGE's *Dynamic Symmetry*. p. 146-157. New Haven, YALE University Press, 1920. 1813

History of these three topics, with very abundant bibliographic references. For a discussion of HAMBIDGE's work see *Isis*, t. IV, p. 32. ARCHIBALD's notes constitute a very valuable *hors d'œuvre*, not an integral part of the book. They first appeared in the *Amer. mathem. monthly*, April and May 1918, but extensive additions and some corrections have been introduced. G. S.

Archibald, R. C. Historical note on the relation $e^{-\pi/2} = i^i$. *The American mathematical monthly*, t. XXVII, p. 116-121, 1921. 1813

This note is preceded by another one by H. S. UHLER giving the values of $e^{-\pi/2}$ and of seven related powers of the same base, with more than 50 places of decimals. G. S.

Archibald, R. C. Perfect numbers. *American mathematical monthly*, vol. 28, p. 140-153, 1921. 1813

Boncompagni, Baldassarre [Roma 1821-1894] (editor). *Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche* pubblicato da B. BONCOMPAGNI. Indici dei venti tomi componenti il presente *Bullettino* (anni 1868-1887). (Serie di indici generali di opere periodiche italiane estinte pubblicati a cura del Dott. ATTILIO NARDECCHIA, No 1), 33 cm., 52 p. Roma, NARDECCHIA, 1915. 1813

(I) Indice per articoli; (II) Indice per nome d'autori; (III) Indice di documenti inediti. G. S.

Hardy, G. H. Some famous problems of the theory of numbers and in particular WARING's problem. (Inaugural lecture), 35 p. Oxford, CLARENDON Press, 1920. 1818

Karpinski, Louis C. The parallel development of mathematical ideas, numerically and geometrically. *School Science and Mathematics*, vol. 20, p. 821-828, 1920. 1818

Loria, Gino. Veicoli al servizio dei calcolatori. *Scientia*, t. XXVIII, p. 77-93. Bologna, 1920. 1818
History of appliances used for computing. G. S.

Muir, Sir Thomas (1845-). The theory of determinants in the historical development, 3 vol. London, MACMILLAN, 1906-1920. 1818

Vol I, 1906, xi + 491 p., from LEIBNIZ (1693), FONTAINE (1748), etc. to 1841; vol. II, 1911, xvi + 475 p., the period 1841 to 1860; vol. III, 1920, xxvi + 503 p., the period 1861 to 1880. A fourth volume, bringing the record up to the end of the nineteenth century, was nearly complete in manuscript in 1918. The author's plan is to include in it a detailed index to the whole work. Let us hope that it may soon appear. G. S.

Roscher, Wilhelm Heinrich Die Zahl 50 im Mythos, Kultur, Epos und Taktik der Hellenen und anderer Völker, besonders der Semiten. (*Abhdl. d. Kgl. sächs. Gesell. d. Wiss., phil. hist. Klasse*, 33. Bd.), 134 p. Leipzig, TEUBNER, 1917. 1818

Russell, Bertrand (1872-). Introduction to mathematical philosophy. London, ALLEN [c. 1919]. 1818

Weinreich, Otto. Triskaidekadische Studien. Beiträge zur Geschichte der Zahlen (*Religionsgesch. Versuche und Vorarbeiten*, t. XVI, 1). Giessen, TÖPELMANN, 1916. 1818

20. — MECHANICS

Carmichael, Robert D. The theory of relativity. Second ed., revised and enlarged (*Mathematical monographs*, No. 12), 112 p. New York, WILEY, 1920. 1818

Carr, H. Wildon. The general principle of relativity in its philosophical and historical aspect, x + 165 p. London, MACMILLAN, 1920. 1818

Eddington, A. S. Space, time and gravitation. An outline of the general relativity theory, vii + 218 p. Cambridge, University Press, 1920. 1818

An excellent introduction to the theory of relativity. Such an immense literature has appeared lately on this subject that it would serve no useful purpose to give a complete bibliography of it in *Isis*, but I try to quote the most important publications which I know of. The reader anxious to have a general but accurate idea of the theory, should read at least EINSTEIN'S popular exposition and EDDINGTON'S book. G. S.

Einstein, Albert (1879-). Ueber die spezielle und die allgemeine Relativitätstheorie, gemeinverständlich. 7^e Auflage. Braunschweig, VIEWEG, 1920. [1^e Aufl., 1917].

1813

Einstein, Albert. Relativity : the special and general theory. A popular exposition. Authorized translation by ROBERT W. LAWSON, xiii + 138 p. London, METHUEN, 1920.

1818

Einstein, Albert. Aether und Relativitäts-Theorie. Rede gehalten am 5 Mai 1920 an der Reichs-Universitäts zu Leiden, 15 p. Berlin, SPRINGER, 1920.

1818

Freundlich, Edwin. The foundations of EINSTEIN's theory of gravitation. Transl. by HENRY L. BROSE. Preface by ALBERT EINSTEIN. Introduction by H. H. TURNER, xvi + 61 p. Cambridge University Press, 1920.

1818

Guillaume, Edouard. Les bases de la théorie de la relativité. *Revue générale des sciences*, t. XXXI, p. 200-210. Paris, 1920.

1818

(I) La mécanique newtonienne; (II) La théorie limitée; (III) La théorie générale.

Haas, Arthur Erich. Die Grundgleichungen der Mechanik dargestellt auf Grund der geschichtlichen Entwicklung, 216 S. Leipzig, VEIT, 1914.

1818

Lecornu, Léon. La mécanique. Les idées et les faits. (Bibliothèque de philosophie scientifique), 304 p. Paris, FLAMMARION, 1918.

1818

Lodge, Sir Oliver J. Inertia. *Scientific monthly*, v. 10, p. 378-387, New York, 1920.

1818

Amplified from a lecture on Ether and Matter, given before the Royal Institution of Great Britain, on Febr. 28, 1919.

Lorentz, Hendrik Antoon. The Einstein theory of relativity, a concise statement, 64 p. New York, BRENTANO, 1920.

1818

First published in the *Nieuwe Rotterdamsche Courant* of Nov. 19, 1919.

Marcolongo, Roberto Lo sviluppo della meccanica sino ai discepoli di GALILEO. *Mem. R. Acc. d. Lincei*, t. XIII, p. 89-138, 1919.

1818

Nature. Special number : Relativity. Vol. 106, no 2677, p. 781-813. London, February 17, 1921.

1818

Contains : A. EINSTEIN, a brief outline of the development of the theory; E. CUNNINGHAM, the growth of an idea; Sir FRANK DYSON, eclipse observations of May 1919; A.-C.-D. CROMMELIN, motion of Mercury's perihelion; CHARLES E. ST. JOHN, displacement of solar lines; G.-B. MATHEWS, non-Euclidean geometries; J.-H. JEANS, general physical theory of relativity; H.-A. LORENTZ, the MICHELSON-MORLEY experiment and the dimensions of moving bodies; Sir OLIVER LODGE, geometrisation of physics and its supposed basis on the MICHELSON-MORLEY experiment; H. WEYL, electricity and gravitation; A.-S. EDDINGTON, relativity of time; NORMAN CAMPBELL,

theory and experiment in relativity; DOROTHY WRINCH and HAROLD JEFFREYS, relation between geometry and relativity; H. WILDON CARR, metaphysical aspects of relativity; select bibliography, p. 811-813.

G. S.

Rieppel, A. v. und Freytag, L. Beiträge zur Entwicklungsgeschichte der technischen Mechanik. *Beitr. zur Gesch. d. Technik u. Industrie*, t. VII, p. 25-40, Berlin, 1917.

1918

Summary of the development of applied mechanics, with special reference to GALILEI, EULER, NAVIER (1785-1836), CLAPEYRON (1779-1864), CASTIGLIANO (1847-1884), KARL CULMAN (1821-1881), OTTO MOHR. G. S.

Sampson, Ralph Allen. On gravitation and relativity Being the HALLEY lecture delivered on June 12, 1920, 24 p. Oxford, CLARENDON Press, 1920.

1918

Schlick, Moritz. Space and time in contemporary physics. An introduction to the theory of relativity and gravitation. Transl. by HENRY L. BROSE. Introduction by F. A. LINDEMANN, xi + 89 p. Oxford, CLARENDON Press, 1920.

1918

Vacca, Giovanni. Sulle origini della scienza dell' elasticità. *Rend. R. Accad. d. Lincei, (fis. mat.)*, t. XXV, p. 29-37. Roma, 1916.

1918

21. — MEDICINE

A. — History, Organization and Philosophy.

Bilancioni, Guglielmo. La storia della Medicina. (Guide I.C.S. Profili bibliografici de l' « Italia che scrive »), 100 p. Roma, Istituto per la propaganda della cultura italiana, 1920.

1914

Another excellent bibliographic guide of Italian literature, this time devoted to the historical studies of medicine. The introduction is divided as follows : (1) Le condizioni degli studi di st. d. med. fra noi ; (2) Sguardo storico alle condizioni di questi studi negli atenei di Europa ; (3) I più illustri storici d. med. in Italia (biographical sketches of SALVATORE DE RENZI, 1800-1872; ANGELO CAMILLO DE MEIS, 1817-1891; FRANCESCO PUCCINOTTI, 1794-1872; ALFONSO CORRADI, 1833-1892; CESARE TARUFFI, 1821-1902); (4) Vicende dell' insegnamento d. st. d. med. in It.; (5) Le società scientifiche e i congressi; (6) Le pubblic. periodiche; (7) La st. d. med. e i suoi rapporti con la storia in generale. The classified bibliography fills up 50 pages closely printed. A most useful book.

G. S.

Boutarel, Maurice. La médecine dans notre théâtre comique depuis ses origines jusqu'au XVI^e siècle. « Mires, fisisciens, naurés » (*Thèse*) 144 p. Caen, LE BOYTEUX, 1918.

1918

Diepgen, Paul. Geschichte der Medizin, 3 Bde., 116 + 118 + 142 S. (*Sammlung Göschen*). Berlin, Vereinigung Wissenschaftlicher Verleger, 1913, 1914, 1919.

1918

Brief but very full summary by an expert scholar : (I) Antiquity; (II) Middle Ages; (III) From Vesalius to the founding of cellular pathology by RUDOLF VIRCHOW (1858).

G. S.

Heinrichs, Heinrich. Die Ueberwindung der Autorität GALENS durch Denker der Renaissance (*Renaissance und Philosophie*, 12 H.), 80 p. Bonn, HANSTEIN, 1914. 1818

Hovorka, Oskar von (Ordinarius des nieder-östrerr. Kinderhauses Gugging bei Wien) Geist der Medizin. Analytische Studien über die Grundideen der Vormedizin, Urmedizin, Volksmedizin, Zaubermé-
dizin, Berufsmedizin, VIII + 364 S. Wien, BRAUMÜLLER, 1915. 1818

A general survey of our knowledge of the origins of medicine, divided into five parts : prehistoric animal and human med. ; protomed. ; popular med. ; magical med. and the principles and the spirit of professional med. — The subtitle " analytic studies " is misleading, for Hovorka's work is rather a popular synthesis of the subject. Numbers in the text refer to a list of 200 books enumerated at the end (p 356-364). G. S.

Kassel, Karl. Geschichte der Nasenheilkunde von ihren Anfängen bis zum 18. Jahrhundert. 1. Bd., 476 p. Würzburg, KABITZSCH, 1914. 1818

Kelly, Howard Atwood and Burrage, Walter L. American medical biographies, 1320 p. Baltimore, NORMAN, 1920. 1818

First publ. 1912 under the title : " Cyclopedica of Am. med. biogr. "

Kingsley, Rose G. The order of St. John of Jerusalem (past and present) 160 p. London, SKEFFINGTON, [1918]. 1818

Miles, A. The Edinburgh school of surgery before LISTER, VIII + 220 p. London, BLACK, 1918. 1818

Moore, Norman. The history of St. BARTHOLOMEW's hospital, 2 vol. 4°, XXII + 614 p., XIV + 992 p. London, PEARSON, 1918. 1818

Neuburger, Max. Entwicklung der Medizin in Oesterreich. 104 p. Wien, FROMME, 1918. 1818

Owslanny, Stanislaus. Aus der polnischen Volksmedizin (Ein Beitrag zur Volkskunde Polens). *Diss.*, Leipzig, 43 p. Posen, 1920. 1818

Polnische Mythologie. Schwangerschaft. Geburt und Wochenbett. Kindesalter. Allgemeine Heilmethoden. Spezielle Heilmethoden. Der Tod. Literaturverzeichnis. G. S.

Pagel, Julius Leopold (1851-1912). Einführung in die Geschichte der Medizin in 25 akademischen Vorlesungen. 2te Auflage, durchgesehen, teilweise umgearbeitet und auf den heutigen Stand gebracht von KARL SUDHOFF, XVI + 616 p. Berlin, KARGER, 1915. 1818

PAGEL's Einführung first appeared in 1897 ; the new edit. prepared by SUDHOFF needs no recommendation. SUDHOFF has managed to introduce into the old frame a very large amount of fresh information. One may object however that some parts, are neither a history, nor a critical bibliography, but something nondescript which will satisfy neither the reader in search of information, nor the scholar trying to find new sources. It is obvious that SUDHOFF would have produced a far more satisfactory history if he had been untrammelled by PAGEL's Outline, — but that would have cost him considerably more time. One must take books as they are. G. S.

Pilcher, Lewis Stephen. A list of books by some of the old masters of medicine and surgery together with books on the history of medicine and on medical biography in his possession. Together with biographical and bibliographical notes and reproductions of some title pages and captions, 201 p. illustr. Brooklyn, New York, 1918.

1818

Rivers, William Halse Rivers. Mind and Medicine. Second ed., 23 p. Manchester University Press, 1920 (first publ. in *Bull. John Rylands Library*, t. V, 1919).

1818

Saintyves, P. Les origines de la médecine. Empirisme ou magie? (*Collection science et magie*, 3), 100 p. Paris, NOURRY, 1920.

1818

For the two previous works by the same author in the same collection see *Isis*, t. II, pp. 242, 478. The present volume discusses the main theories on the origin of medicine. It is divided as follows: (I) L'origine empirique; (II) La thérapeutique magique; (III) La thérapeutique sacerdotale; (IV) Empirisme et raisonnement dans la médecine mystique. His main conclusion is that there is no essential difference between primitive, mystical empiricism and modern scientific empiricism. « Il n'y a point de mentalité prélogique. La raison instinctive... est une raison qui ne s'est pas encore critiquée elle-même ou du moins à peine, mais c'est déjà la raison. Il y a une raison précritique, il n'y a point de raison alogique. »

G. S.

22. — MORALS

Murray, Gilbert (1866-). Satanism and the world order. 46 p. London, ALLEN, 1920.

1818

Raymond, George Lansing (1839-). Ethics and natural law. A reconstructive review of moral philosophy applied to the rational art of living, xxxiii + 345 p. New York, PUTNAM, 1920.

1818

23. — PHARMACY AND PHARMACOLOGY

Kremers, Edward. The history of American pharmacy. *American Druggist*, March, p. 9-13, April, p. 9-14, May, p. 13-18, with many illustrations. New York, 1920.

1818

The first paper deals with the Colonial period, the second with the War of Independence and the Reconstruction period the third with the changes in pharmaceutical economics. Original documents, portraits, etc., are reproduced.

G. S.

Schmidt, Alfred. Die Kölner Apotheken bis zum Ende der reichstädtischen Verfassung. Vornehmlich auf Grund des von FRIEDRICH BELLINGRODT gesammelten Materials verfasst und hrg. x + 160 p., 25 pl. Bonn, HANSTEIN, 1918.

1818

24. — PHILOSOPHY. HISTORY OF PHILOSOPHY

(See also 30 D. *Science, philosophy.*)

Comte, Auguste. La méthode positive en 16 leçons, condensée par J. EMILE RIGOLAGE (JULES RIG), viii + 333 p. Paris, VIGOT, 1917.

1818

Ceci est un résumé du résumé en quatre volumes publié antérieurement par le même auteur. Il est divisé comme suit : (1) Nature et importance de la méthode positive; (2) Hiérarchie des sciences positives; (3) Science mathématique abstraite; (4) Géométrie; (5) Mécanique; (6) Astronomie; (7) Physique; (8) Chimie; (9) Biologie; (10) Sociologie; (11) Statique sociale; (12) Dynamique sociale; (13) Evolution des sociétés humaines; (14) La révolution française; (15) Ensemble de la méthode positive; (16) Action finale propre à la méthode positive. G. S.

McCabe, Joseph Martin (1867-). A biographical dictionary of modern Rationalists, 4°, xxxii + 934 col. London, WATTS, 1920.

1818

The Rationalists collected by McCABE in this dictionary are the men who uphold the right of reason against the authority of Church or tradition. Rationalism in this sense, is primarily a mental attitude. The dictionary covers the period beginning with the death of GIORDANO BRUNO in 1600. Of the men (and women) included, there are about 100 of the period preceding the French Revolution, and about 200 of the first half of the nineteenth century, the vast majority belong to this or the last generation. The selection may appear sometimes a little capricious; yet it is interesting and useful.

G. S.

Marvin, Francis Sydney (editor). Recent developments in European thought. Essays arranged and edited, 306 p. London, MILFORD, 1920.

1818

Moog, Willy. Philosophie. (*Wissenschaftliche Forschungsberichte*, V), x + 106 S. Gotha, PERTHES, 1921. [8 Mk.]

1818

The aim of the collection is to give a general survey of the work done during the war in the various fields of knowledge. Previous vol. were devoted respectively to French, Latin, German and Greek philology. The review of philosophical lit. (chiefly German) seems very elaborate; it is a critical and select bibliography. Contents : (1) Der Krieg u. der Philosophie; (2) Einl. in d. Phil.; (3) Geschichte d. Philos. (p. 14-42); (4) Logik u. Erkenntnistheorie; (5) Metaphysik u. Weltanschauungslehre; (6) Ethik; (7) Aesthetik; (8) Religionsphilos.; (9) Naturphilos.; (10) Geschichts- u. Kulturphilos.; (11) Rechts-, Gesellschafts- u. Staatsphilos. Indexes. G.S.

Spaulding, Edward Gleason. The new rationalism. The development of a constructive realism upon the basis of modern logic and science and through the criticism of opposed philosophical systems, xviii + 532 p. New York, 1918.

1818

Vaihinger, Hans und Schmidt, Raymund (editors). Annalen der Philosophie, mit besonderer Rücksicht auf die Probleme der Als-Ob-Betrachtung. Erster Band, viii + 681 S. Leipzig, MEINER, 1919.

1818

A new philosophical collection for the further elaboration of HANS VAIHINGER's pragmatic philosophy, first explained by him in his *Philosophie des Als-Ob*, Berlin, 1911, 4th ed. Leipzig, 1920. This first vol. contains 15 essays considering the « As if » philosophy from as many different points of view. This philosophy is a new attempt to conciliate idealism and positivism. G. S.

25. — PHYSICS

Fowle, F. E. (*editor*). Smithsonian physical tables. Seventh revised edition, XLVI + 450 p. Washington, Smithsonian Institution, 1920.

1818

Karpinski, Louis C. A brief historical consideration of the metric system. *Science*, vol. 53, p. 156-157, 1921.

1818

Planck, Max. Die Entstehung und bisherige Entwicklung der Quantentheorie. 32 p. Leipzig, BARTH, 1920.

1818

Silberstein, L. Report on the quantum theory of spectra, iv + 42 p. London, HILGER, 1920.

1818

Soddy, Fred. Le radium. Interprétation et enseignement de la radio-activité. Trad. par A. LEPAPE (*Nouvelle collection scientifique*), 375 p. Paris, ALCAN, 1919.

1818

Translation of the third English ed., with appendix describing the progress made from 1914 to 1919.

Watt, Henry Jackson. The foundations of music, XIII + 240 p. Cambridge University Press, 1919.

1818

26. — PHYSIOLOGY

Arthur, Maurice. La physiologie. 430 p. Paris, MASSON, 1920.

1818

Haldane, John Scott. The new physiology and other addresses, VII + 156 p. London, GRIFFIN, 1919.

1818

Harvey, E. Newton. The nature of animal light (*Monographs in experimental biology and general physiology*), 182 p. Philadelphia, LIPPINCOTT, 1920.

1818

Keith, Arthur. The engines of the human body (*Christmas lectures at the Royal Institution, 1916-1917*), XII + 284 p. London, WILLIAMS and NORGATE, 1919.

1818

Parker, George Howard. The elementary nervous system, 229 p., 53 fig. Philadelphia, LIPPINCOTT, 1919.

1818

27. — PREHISTORY

Hoernes, Moriz. Urgeschichte der bildenden Kunst in Europa, von den Anfängen bis um 500 v. Chr. Zweite, durchaus umgearbeitete und neu illustrierte Auflage, mit 1330 Abb. im Text, xiv + 661 p. Wien, HOLZHAUSEN, 1915.

1818

First ed. 1898. A very valuable work of reference published with the assistance of the Kais. Akad. d. Wiss. — Main subdivisions: (1) Quellen u. Richtungen der bildenden Kunst; (2) Die prähistorische Kunst in Europa; (3) Der Westen u. die naturalistische Kunst des Jägartums; (4) Mitteleuropa u. die geometrische Kunst des Bauerntums; (5) Kulturkreise u. Kunstrichtungen der jüngeren Steinzeit u. der Kupferzeit; (6) Der Südosten u. der Kulturkreis der Bronzezeit; (7) Kulturkreise und Entwicklungen der Eisenzeit. Nachträge u. Nachweisungen.

G. S.

Jackson, J. Wilfrid. Shells as evidence of the migrations of early culture, xxviii + 216 p., illustr. Manchester, University Press, 1917. 1818

Research inspired by GRAFTON ELLIOT SMITH.

G. S.

Kossinna, Gustaf. Die deutsche Vorgeschichte, eine hervorragend nationale Wissenschaft. 2te stark vermehrte Auflage. vii + 255 p., illustr. (*Mannus Bibliothek*, 9). Würzburg, KABITZSCH, 1914. 1818

Miller Jr., Gerrit S. The Jaw of the Piltdown man. Smithsonian Miscellaneous Collections, vol. 65, n° 12, 31 p., 5 pl. Washington, 1915. 1818

Discussion of the published opinions on this subject and new study based on comparisons with other human jaws and skulls and the jaws of the *Pongidae* in the U. S. National Museum. MILLER is convinced that the Piltdown jaw and the other skull fragments found near by do not belong to the same individual. Extensive and critical bibliography.

Moir, J. Reid. Pre-palæolithic man, 67 p., 29 pl. Ipswich, HARRISON, [c. 1919]. 1818

Read, Carveth. The origin of man and of his superstitions, xii + 350 p. Cambridge University Press, 1920. 1818

Schuchhardt, Carl. Alteuropa in seiner Kultur-und Stilentwicklung, xii + 350 p. Strassburg, TRÜBNER, 1919. 1818

Wilser, Ludwig (1850-). Deutsche Vorzeit. Einführung in die germanische Altertumskunde. 240 p., illustr. Steglitz-Berlin, HOBING, 1917. 1818

28. — PSYCHOLOGY

Boirac, Emile (1851-) The psychology of the future. Transl. with an introd. by W. DE KERLOR, ix + 316 p. London, KEGAN, PAUL, [c. 1918]. 1818

Carter, Huntly (editor). Spiritualism. Its present day meaning. A symposium. London, FISHER UNWIN, 1920. 1818

Dessoir, Max (1867-). Vom Jenseits der Seele. Die Geheimwissenschaften in kritischer Betrachtung, viii + 344 p. Stuttgart, ENKE, 1917. 1818

Knowlson, Thomas Sharnol. Originality. A popular study of the creative mind, xvi + 304 p. London, WERNER LAURIE, 1917. 1818

McCabe, Mac. Spiritualism. A popular history from 1847. London, FISHER UNWIN, 1920. 1818

Preyer, William (1841-1897). Zur Psychologie des Schreibens mit besonderer Rücksicht auf individuelle Verschiedenheiten der Handschriften. 2. Auflage mit einer Ergänzung von TH. PREYER, vi + 256 p. Leipzig, Voss, 1919. [1. Aufl. 1895]. 1818

Psychic Research Quarterly, The, vol. I, no. I. July 1920. London, KEGAN PAUL, TRENCH, TRUBNER & Co. 1818

The aim of this new periodical is to stimulate the scientific study and reasoned criticism and discussion of psychical research. The first no. contains an excellent introductory essay by F. C. S. SCHILLER on Scientific method and psychical research, one by Sir WILLIAM BARRETT on the so-called Divining (or Dowsing) Rod and four others; also 5 book reviews.

G. S.

Rabaud, Etienne. *Prescience et causes actuelles dans l'instinct. Scientia*, t. xxvii, p. 442-452. Bologna, 1920. 1818

Discussion of various experiments to destroy the superstitious exaggerations of the notion of instinct.

G. S.

Schrenck von Notzing, Albert Philibert Franz, Freiherr von 1862-). *Materialisationsphaenomene, ein Beitrag zur Erforschung der mediumistischen Telepathie*, xi + 523 p., 150 fig., 30 pl. München, REINHARDT, 1914 [1913]. 1818

An English transl. with additions from a supplementary book by Baron von SCHRENCK, was published by KEGAN PAUL, London, c. 1920. G. S.

Smith, E. M. *The investigation of mind in animals*. ix + 194 p. Cambridge University Press, 1915. 1818

Tansley, Arthur George. *The new psychology and its relation to life*. London, ALLEN, 1920. 1818

Ward, James (1843-). *Psychological principles*, xiv + 478 p. Cambridge University Press, 1918. 1818

Watson, John B. *Psychology from the standpoint of a behaviorist*, 430 p. Philadelphia, LIPPINCOTT, 1919. 1818

Wundt, Wilhelm (1832-1920). *Vorlesungen über die Menschen- und Tierseele*, xvi + 579 p. Leipzig, Voss, 1919. 1818

29. — RELIGION. HISTORY OF RELIGION. RELIGION AND SCIENCE

Alfaric, Paul. *Les écritures manichéennes. Leur constitution, leur histoire. Etude analytique*, 2 vol., iii + 154 + 240 p. Paris, NOURRY, 1918. 1818

Dussaud, René. *Introduction à l'histoire des religions Bibliothèque historique des religions*, I, vi + 292 p. Paris, LEROUX, 1914. 1818

Very clear and very well-informed summary of the fundamental religious facts with a generous account of the various theories devised to connect and to explain these facts. The plan is interesting: (1) Naturisme, animisme, préanimisme; (2) Totémisme; (3) Principe de vie; (4) Ame; (5) Dieux de la nature; (6) Dieux de groupe; (7) Représentations matérielles; (8) Sanctuaire; (9) et (10) Sacrifice; (11) Prière; (12) Mort; (13) Initiation et consécration. Fêtes; (14) Péché et Tabous; (15) Mythes et Dogmes; (16) Notions morales. His survey has led the author to the following minimum definition of religion (p. 290): « une religion est constituée par un ensemble organisé de croyances et de rites qui se propose d'accroître et de perpétuer le principe de vie de l'individu, du groupe et de la nature. » G. S.

Gemelli, Fr. Agostino (O. F. M.). *Religione e scienza (Saggi apologetici, II)*, XII + 347 p. Milano, Vita e Pensiero, 1920. 1818

A series of essays on the relations between positive science and religion from the Roman Catholic point of view. (I) Il conflitto di religione e scienza; (II) Bestie che pensano e che fanno di conti e... uomini che non ragionano; (III) I miracoli della biologia; (IV) Spiritismo e spiritisti; (V) Una epidemia diffusa dalle pratiche religiose; (VI) Il processo e la condanna di GALILEO. G. S.

Lake, Kirsopp. *Landmarks in the history of early Christianity.* London, MACMILLAN, 1920. 1818

Langer, Fritz. *Intellectualmythologie. Betrachtungen über das Wesen des Mythos und die mythologische Methode*, XII + 269 p. Leipzig, TEUBNER, 1916. 1818

Lods, Ad. L' « école de Strasbourg » et son influence sur l'étude des sciences religieuses en France au XIX^e siècle. *Revue de l'histoire des religions*, t. LXXXI, n° 2, mars 1920, p. 105-134. Paris, LEROUX. 1818

La France paraît montrer un intérêt croissant à l'histoire des religions : la fondation en 1920 de la « Société Ernest Renan » et de l' « Association française des Amis de l'Orient » (siège commun au Musée Guimet, Paris) constitue à cet égard un double indice. Dans ces conditions le retour de l'Alsace à la patrie française pourrait être un événement plein de promesses, si l'on pense qu'avant 1870 il n'y avait pas en France de plus actif foyer d'études religieuses que Strasbourg, et que depuis lors nombre des maîtres qui entretenaient à Paris l'intérêt pour ces études furent d'anciens élèves de l'Université alsacienne. M. AD. LODS rend donc un réel service en rappelant toute l'importance de l'œuvre accomplie par la Faculté de Théologie de Strasbourg, dont REUSS (1804-1891) et CHARLES SCHMIDT (1812-1895) furent les gloires. Œuvre d'adaptation de la science allemande à la pensée française; de développement de la haute culture au sein d'un luthéranisme auquel se montraient de plus en plus attentifs les calvinistes du sud de la France; mais œuvre scientifique aussi, puisqu'elle suscita des monuments tels que cette *Bible* dans laquelle REUSS se révèle initiateur de la théorie de WELLHAUSEN. P. MASSON-OURSSEL.

Woodburne, Angus Stewart. *The relation between religion and science. A biological approach.* VII + 103 p. Chicago, University Press, 1920. 1818

30. — SCIENCE

B. — History

Brasch, Frederick E. *The history of science section and the progress of science.* *Science*, vol. 52, p. 559-562, 1920. 1818

Brasch, Frederick E. *Report of the History of Science sessions of the American Association for the Advancement of science.* (Dec. 27 1920 to Jan. 1, 1921, Chicago). *Science*, vol. 53, p. 315-318, 1921. 1818

Crew, Henry. The problem of the history of science in the college curriculum, *Scientific monthly*, vol. 10, p. 475-481, New York, 1920.

1818

Duhem, Pierre (1861-). La science allemande, 146 p. Paris, HERMANN, 1915.

1818

France. Ministère de l'instruction publique et des beaux-arts. La science française, 2 vol. illustrés de portraits. Paris, LAROUSSE, 1915.

1818

Matschoss, Conrad. Ein Besuch im Deutschen Museum in München. *Zeitschrift des Vereines deutscher Ingenieure*, p. 976 sq., illustr. Berlin, 1907.

1818

Mieli, A. Il contributo dato dai diversi paesi allo sviluppo della storia della scienza *Scientia*, t. xxix, p. 89-100, 1 fevr. 1921. Trad. française : supplément, 21-32.

1818

Les grands noms de l'histoire de la science, les collections de classiques, les principaux périodiques. (Cette note sert en quelque sorte de préface à une enquête poursuivie par *Scientia* sur la contribution apportée par les divers pays au progrès des différentes branches de la science.) L. G.

München. Deutsches Museum von Meisterwerken der Naturwissenschaften und Technik. Rundgang durch die Sammlungen (21. bis 25. Tausend) 20 × 24,5, 40 p., 31 illustr. München [no date].

1818

A short and well illustrated guide for the visitor to the Deutsches Museum, that is the Museum of the development of science and technology, founded in Munich in 1903 and which is already exceedingly rich and is admirably organized. This institution is partly supported by the subscriptions of its friends. G. S.

München. Deutsches Museum. Bericht über die unter dem Vorsitze Sr. Kgl. Hoheit des Prinzen Ludwig von Bayern am 28 Juni 1903... erfolgte Gründung des Museum von Meisterwerken der Naturwissenschaft und Technik, 20 p., 32 × 21 cm. München, 1903.

1818

München. Deutsches Museum. Denkschrift über den Bibliotheksbau des Deutschen Museums, 12 p., 32 × 21 cm., 10 illustr., 3 plates. München [no date].

1818

Short description of the building itself and of its treasures : books, prints, MSS., autographs, coins, portraits. G. S.

München. Deutsches Museum. Denkschrift über den Neubau des Deutschen Museums, 30,5 × 20,5 cm., 12 p. München, 1920.

1818

Olschki, Leonardo. Die Literatur der Technik und der angewandten Wissenschaften vom Mittelalter bis zur Renaissance (Geschichte der neusprachlichen wissenschaftlichen Literatur, 1 Bd.), xii + 460 S. Heidelberg, C. WINTER, 1919.

1818

The aim of the author is to study the literature of science (or science from the literary point of view), but a deep union between substance and form could only exist when scientists began to use their own native tongue. After a relatively short chapter devoted to medieval literature, the author

studies successively the scientific writings and the personalities of : L. B. ALBERTI ; LORENZO GHIBERTI ; A. A. FILARETE ; FRANC. DI GIORGIO MARTINI ; PIERO DE' FRANCESCHI ; LUCA PACIOLI and finally LEONARDO DA VINCI (p. 252-413). Appendixes deal with A. DÜRER ; — the Latin translations of Arabic scientific writings ; — the duplication of the cube according to HEINRICH SCHREIBER and DÜRER. G. S.

Paoli, Humberto Julio. Contributi alla scienza sud americana, ed alla sua storia, e la « Collección de libros referentes à la ciencia hispano-americana ». *Archivio di storia della scienza*, t. I, p. 440-442. Roma, 1920. 1818

Short notes to announce the publication of a collection of reprints of the early South American scientific books with all necessary notes. The three first books to appear are : A. A. BARBA. *Arte de los metales...* (written 1640), Madrid 1729 ; MONARDES NICOLÁS. *Primera y Segunda y Tercera Partes de la Historia Medicinal...*, Sevilla 1580 ; PERES DE VERGOS. *Los nueve libros de re metallica...*, Madrid 1569. Dr H. J. PAOLI will edit these three volumes (address : Av. General Rodriguez 1669, Banfield, Argentine Rep.) G. S.

Sarton, George. Report to the Carnegie Institution of Washington [on his work from July 1919 to the end of August 1920]. Year Book No. 19 (1920), p. 383-385. Washington D. C. 1921. 1818

(1) Work in Europe (July 17, 1919 — Jan. 27, 1920) ; (2) History of Science ; (3) LEONARDO studies (interrupted) ; (4) History of physics in the nineteenth century ; (5) The new humanism. G. L.

Thorndike, Lynn. The Washington conference on the history of science. *Science*, vol. 53, p. 122, 1921. 1818

Report of conference held in Washington, Dec. 1920 at the same time that another conference was held in Chicago, for which see BRASCH' paper quoted above. G. S.

C. — Organization

Andrews, Roy Chapman. New expedition to Central Asia. *Natural History*, vol. xx, p. 349-355. New York, 1920. 1818

Attention is called upon this expedition partly because it will be the first great systematic attempt to study Central Asia, partly because it will be the basis of the Chinese Museum of Natural History to be founded in Peking, as a duplicate set of the collections will be left in China for that purpose. It may be also the beginning of an archaeological survey of China. A special effort will be made in the field of palæoanthropology ; central Asiatic palæontology is still in its infancy. The work will be carried on under the name of « the third Asiatic expedition of the American Museum of Natural History, in coöperation with the American Asiatic Association and Asia Magazine ». the field work will last five years, and the estimated cost is \$ 250.000. G. S.

Hale, George Ellery. The international organization of scientific research. *International Conciliation*, no. 154, p. 431-441. Greenwich, Conn., 1920. 1818

Explains the aims and organization of the International Research Council founded in Brussels, July 1919, after two preliminary inter-allied conferences in London, Oct. and Paris, Nov. 1918. This International council is a

federation of the various national research councils. Its permanent headquarters are in Brussels where it will meet triennially. HALE describes briefly a few other international scientific organizations devoted to special sciences. Although a child of hatred, let us hope that as years go by this organization will become really international. G. S.

Henderson, I. F. and W. D. A dictionary of scientific terms. Pronunciation, derivation and definition of terms in biology, botany, zoology, anatomy, cytology, embryology, physiology, viii + 354p. Edinburgh, OLIVER and BOYD, 1920. 1818

Kellogg, Vernon. The National Research Council. *International Conciliation*, no. 154, p. 423-430. Greenwich, Conn. 1920. 1818

Explains the aims of this "cooperative organization of the scientific men of America", improvised in 1916, reorganized in 1918 as a permanent body. It is established under the auspices of the National Academy of Sciences; it is not at all a governmental institution. A gift of five million dollars from the Carnegie Corporation will be devoted partly to erect a building in Washington for the joint use of the Council and the National Academy, partly to endow the Council. G. S.

Leland, Waldo G. The International Union of Academies and the American Council of Learned Societies. *International Conciliation*, no. 154, p. 442-457. Greenwich, Conn., 1920. 1818

New « international » union organized in Paris, 1919 (first meeting Brussels 1920) to supersede the old union. Each country is entitled to two delegates and two votes; the headquarters are established in Brussels. This Union is the counterpart of the International Research Council, with regard to the so-called humanistic studies, that is: philosophy, philology, archaeology, history, economics, and the political and social sciences. As the International Research Council, it was originally inspired by hatred rather than by love. — The American Council of Learned Societies was organized to insure an effective American participation in the activities of the new international union. G. S.

Mees, C. E. Kenneth. The organisation of industrial scientific technical research, ix + 175 p. New York, McGRAW-HILL, 1920. 1818

Merriam, John C. The research spirit in every day life of the average man. *Science*, vol. 52, p. 473-478. Nov. 19, 1920. 1818

Otlet, Paul. L'organisation des travaux scientifiques. Extrait du volume des conférences de l'Association française pour l'avancement des sciences, année 1919, 40 p. Paris, 28, rue Serpente. 1818

Développement des idées de l'auteur sur l'Organisation générale de la documentation, avec renvoi à ses travaux antérieurs. Il est impossible de résumer cet exposé si serré et si complet. Lecture mélancolique, car hélas! dans ce domaine le génie d'un homme reste impuissant s'il n'est secondé par la bonne volonté *unanime, soumise et continue* de milliers d'autres... Il n'y a qu'une sorte de religion qui pourrait créer le dévouement intarissable nécessaire à l'accomplissement d'une œuvre aussi vaste. G. S.

Pearson, Karl. The function of science in the modern state. Second edition, vii + 97 p. Cambridge University Press, 1919. 1818

First published as introduction to vol. 32 of the tenth ed. of the *Encyclopædia Britannica*.

Veblen, Thorstein B. The place of science in modern civilization 509 p. New-York, HUEBSCH, 1919. 1818

Wheeler, William Morton. The organization of research. *Science*, vol. 53, p. 53-67, 1921. 1818

A most interesting satire of the excesses of "organization" in science, full of wit and wisdom. G. S.

D. — Philosophy

Barrell, Joseph, Charles Schuchert, Lorande Loss Woodruff, Richard Swann Lull, Ellsworth Huntington. The evolution of the earth and its inhabitants, xi + 208 p. New Haven, YALE University Press, 1919. 1818

Elliot, Hugh. Modern science and materialism. 211 p. London, LONGMANS, 1919. 1818

More, Louis Trenchard. The limitations of science, 268 p. New York, HOLT, 1915. 1818

Vailati, Giovanni [Crema, 1863-Firenze, 1906]. Gli strumenti della conoscenza. Con prefazione di MARIO CALDERONI. (*Cultura dell'anima*, 49). Lanciano, CARABBA, 1919. 1818

VAILATI was one of the best informed and the wisest men of contemporary Italy. A complete edition of his writings (excepting his *Teoria delle Proporzioni*, edited after his death by F. ENRIQUES) was published in Florence, 1911. The present booklet reprints five papers, three of which are of special interest to the historian of science: (1) Sull' importanza delle ricerche relative alla storia delle scienze (1896); (2) Il metodo deduttivo come strumento di ricerca (1898); (3) Questioni di parola nella storia della scienza e della cultura (1898); (4) Sull' applicabilità dei concetti di causa e di effetto nelle scienze storiche (1903); (5) Pragmatismo e logica matematica (1906). A biography by CALDERONI (17 p., 1909) and a bibliography are added.

G. S.

Whitehead, A. N. An enquiry concerning the Principles of Natural Knowledge, xii + 200 p. Cambridge, University Press, 1919. 1818

Whitehead, A. N. The Concept of Nature. Tarner Lectures delivered in Trinity College, Nov. 1919, x + 202 p. Cambridge, University Press, 1920. 1818

A companionbook to the author's *Enquiry concerning the Principles of Natural Knowledge*, which dealt chiefly with ideas directly drawn from mathematical physics. The present book keeps closer to certain fields of philosophy and physics to the exclusion of mathematics. The two works meet in their discussions of space and time. G. S.

31. — SOCIOLOGY, JURISPRUDENCE AND POSITIVE POLITY

Beer, M. A history of British socialism. With an introduction by R. H. TAWNEY, 2 vol. xxii + 361, xii + 413 p. London, BELL, 1920. 1818

Completely rewritten translation of the original German text of 1912.
Vol. I. (1) Mediæval communism; (2) 1760-1834. — Vol. II. (3) Chartism;
(4) Modern socialism, 1855-1920. Elaborate indexes. G. S.

Burns, Cecil Delisle. Political ideals, their nature and development.
Third edition, enlarged, 357 p. London, MILFORD, 1919. 1813

Dunning, William Archibald. A history of political theories, 3 vol.
New York, MACMILLAN, 1902-1920. 1813

(I) 1902 (new ed. 1916) Ancient and mediæval; (II) 1905 (new ed. 1916).
From LUTHER to MONTESQUIEU; (III) 1920. From ROUSSEAU to SPENCER.

Flexner, Abraham. Prostitution in Europe, ix + 455 p. Introduction by
JOHN D. ROCKEFELLER, jr. New York, Century, 1919. 1818

Follet, Mary Parker. The new state; group organization, the solution
of popular government. 3rd. impression. With introduction by
LORD HALDANE. New York, LONGMANS, 1920 (cop. 1918). 1813

Goedeckemeyer, Albert. Die Idee vom ewigen Frieden. (Philoso-
phische Zeitfragen), 77 S. Leipzig, FELIX MEINER, 1920. [M. 5] 1818

(1) Der Wert dieser Idee (includ. a short history); (2) Die Möglichkeit
des ewigen Friedens; (3) Die Verwirklichung des ewigen Friedens.
Schluss. G. S.

Guyot, Yves (1843-), **Germain Paturel, G. Schelle, J. Pierson,**
Frédéric Mathews. Le libre échange international. Six conféren-
ces organisées en 1918 par la Ligue du Libre-Echange et l'Ecole
des Hautes Etudes Sociales, iv + 228 p. Paris, ALCAN, 1918. 1813

Ireland, Alleyne. Democracy and the human equation. New York, Dut-
ton, 1921. 1813

Laski, Harold J. Authority in the modern state. 398 p. New Haven,
YALE University Press, 1919. 1813

Müller-Lyer, Franz (1857-). The history of social development.
Transl. by ELIZABETH C. and H. A. LAKE. 362 p. London, ALLEN
[1920]. 1818

Pareto, Vilfredo (1848-). Traité de sociologie générale. Ed. fran-
çaise par PIERRE BOVEN, revue par l'auteur, 2 vol. Lausanne,
PAYOT, 1917-1919. 1813

Rathenau, Walther (1864-). Die neue Gesellschaft. Berlin, FISCHER.
1919. 1818

English transl. by ARTHUR WINDHAM. The new society. New York,
HARCOURT, 1921.

Ross, Edward Alsworth (1866-). The principles of sociology,
xviii + 708 p. New York, Century, 1920. 1818

Sayre, Francis Bowes. Experiments in international administration.
Vol. I. 200 p. New York, HARPER, [1919]. 1818

Solvay, Ernest. *Energétique sociale. La rémunération comparative du capital et du travail*, 25 p. Bruxelles, F. VAN BUGGENHOUDT, 1919.

1818

Correspondance avec E. VANDERVELDE.

Trotter, W. *Instincts of the herd in peace and war*, 213 p. London, UNWIN, 1916; New York, MACMILLAN, 1917.

1818

First two essays published in the *Sociological Review*, 1908-1909.

Vinogradov, Pavel Gavrilovich (1854-). *Outlines of historical jurisprudence* by Sir PAUL VINOGRADOFF. Vol. 1, ix + 428 p. London, MILFORD, 1920.

1818

Wheeler, William Morton. *The termitodoxa, or biology and society. The scientific monthly*, v. 10, p. 113-124. New York, Febr. 1920.

1818

A magnificent satire of human society which prof. WHEELER copied from a letter recently addressed to him by WEE-WEE, 43 d. Neotenic King of the 8429th. dynasty of bellicose termites.

G. S.

32. — STATISTICS

Gini, Corrado (editor). *Metron. International review of statistics.* Vol. 1, no. 1. Rovigo (Veneto), Industrie grafiche italiane, July 1920.

1818

A new quarterly devoted to theoretical statistics and to the applications of general interest. The four numbers of each year will form a volume of 700 to 800 p., costing 50 lire. *Metron* will be an international center of information on all statistical matters. It will be published in four languages. Editorial committee : A. ANDREADÈS, A.-E. BUNGE, F.-P. CANTELLI, L.-V. FURLAN, M. GREENWOOD, G.-H. KNIBBS, L. MARCH, A. JULIN, R. PEARL. Editor's address : Dept. of statistics, University of Padova, Italy.

Knibbs, George Handley (1858-). *The mathematical theory of population, of its character and fluctuations and of the factors which influence it, etc. (Report of the Australian census for 1911, vol. I, Appendix A)*, xvi + 466 p. Melbourne, McCARRON BIRD Co, [1917].

1818

The first vol. of this Report also contains a history of census-taking.

G. S.

Simiand, François. *La statistique comme moyen d'expérimentation et de preuve. Journal de la société de statistique.* Paris, Février 1921, p. 37-49, 1921.

1818

33. — SUPERSTITION AND OCCULTISM

Bassett, Wilbur. *Wanderships. Folk-stories of the sea, with notes upon their origin*, 136 p. Chicago, Open Court, 1917.

1818

Besant, Annie and Charles W. Leadbetter. *Occult chemistry. Clairvoyant observations on the chemical elements.* Revised edition ed. by A. P. SINNETT, 110 p. London, Theosophical publishing house [c. 1919, not seen].

1818

Clodd, Edward. Magic in names and in other things, 232 p. London, CHAPMANN, 1920. 1818

Dauzat, Albert. Légendes, prophéties et superstitions de la guerre. Paris, Renaissance du Livre, c. 1919. 1818

Ellis, Arthur J. [b. in Kansas 1885-d. 1920] The Divining Rod: a history of water witching. United States Geological Survey, Water-Supply paper #16, 59 p., 4 illustr. Washington, 1917. 1818

Brief history of the subject followed by an extensive bibliography in chronological order: from about 1532 (Ph. MELANCHTON, 15—; BERNHARDUS, 1532; AGRICOLA, 1556) until 1916. This bibliography occupies half of the book. KLINCKOWSTROEM's bibliogr. (1911) and BIROT and ROUX's (1912) have been used. Introductory note by O. E. MEINZER. The text is divided as follows: form of the div. rod; its origin; spread of the delusion; origin of "water witching"; ecclesiastical controversies; use of the rod in detecting criminals; scientific controversies; mechanical water finders. The author was assistant chief of the Ground Water Division of the U. S. Geological Survey. A short obituary appeared in *Science*, vol. 52, p. 127, 1920. G. S.

Haenel, H. Zur physiologischen Mechanik der Wünschelrute. Mit einem Anhang: Beobachtungen an dem Rutengänger DONATH, mit 13 Abb. 42 p. (*Schriften des Verbands zur Klärung der Wünschelrutenfrage*). Stuttgart, WITTE, 1918. 1818

The aim of the author has been to study in a scientific way not the explanation, but simply the mechanism of the divining rod. He lays special stress on the fact that the rotating mechanism of the hand (in supination and pronation) is extremely sensitive; the two delicate mechanisms of both hands added to the elasticity of the rod constitute an instrument of incredible sensitiveness. The substance searched for acts in some way upon the nervous system of the observer. The appendix is a study of the extraordinary rhabdomandist ADOLF DONATH. — Studies on the divining rod are classified in this section, simply because as long as these phenomena are not satisfactorily explained it is legitimate to call them "occult", but investigations as those undertaken by HAENEL and his friends should be encouraged, by all means. G. S.

Hellmann, G. Wetterpropheten des XIX. und XX. Jahrhunderts. *Beitr. zur Gesch. d. Meteorologie*, nr. 9, t. II, p. 233-314. Berlin, 1917 1818

By "weatherprophets", HELLMANN means men who believe that they can forecast the weather for long or even arbitrary periods. He does not include among them, those who have simply developed theoretical considerations on the possibility of such long-dated prevision. This memoir contains a large amount of information on 105 weather-prophets, among whom 36 Germans, 25 Englishmen, 14 Frenchmen, 9 North Americans, 8 Austro-Hungarians, 5 Swiss. This is a capital contribution to the history of human folly. — It grieves me to find LAMARCK's name in this list, but as he forecast the weather for a whole year ahead from 1800 to 1811, he deserves this opprobrium. G. S.

Hellwig, Albert. Weltkrieg und Aberglaube. Erlebtes und Erlauschtes. VIII + 159 p. Leipzig, HEIMS, 1916. 1818

Lippmann, Edmund O. von. *Diamant und Bocksblut; ein Beitrag zur Volkskunde.* *Chemiker Zeitung*, 1921, nr. 1 (Abdruck, 14 p.). 1913

Apropos of an old superstition according to which the blood of a he-goat can dissolve diamonds. LIPPMANN tells its history throughout the ages, the oldest source being PLINY's *Natural History*, lib. 20, cap. 1; lib. 37, cap. 15. G. S.

Spence, Lewis. *An Encyclopædia of Occultism.* A compendium of information on the occult sciences, occult personalities, psychic science, magic, demonology, spiritism and mysticism, xiv + 451 p., in 4°, illustr. London, ROUTLEDGE, 1920. 1918

A compilation which has been made very seriously by one who without believing in the occult, is open minded and sympathetic. As the first scientific effort of this kind, it will be very useful, although it is only as the author candidly admits, a beginning. Few references are given in the text but a short select bibliography is placed at the end of the introduction. Scientific hypotheses concerning magic have been summarized, though the author's main ambition has been rather to give as complete an account as possible of the magical facts and beliefs. G. S.

34. — TECHNOLOGY

(For mining, see geology; for industrial chemistry, chemistry.
See also arts and crafts)

Artiñano y de Galdácano, Gervasio de. *La arquitectura naval española (en Madera). Bosquejo de sus condiciones y rasgos de su evolución.* (Conferencias organizados por el « Instituto de ingenieros civiles de España » en el Ateneo de Madrid, Mayo de 1914). [fº, 428 p., 80 pl.]. Editada en Madrid por el autor. Año de nuestra salud, MCMXX. 1918

A sumptuous publication enriched with a large collection of plates and illustrations (portraits, fac-similes of MSS., representations of ships, technical drawings, etc.). Many of the plates are in colour. This volume is a credit to Catalan typography. The text is divided into two main parts: (I) Beginnings and mediæval progress. Epoch of the House of Austria; (II) The first fifty years of the Bourbons. G. S.

Dean, Bashford (1867-). *Helmets and body armour in modern warfare.* 325 p. New Haven, YALE University Press, 1920. 1918

[**Feldhaus, Franz M.**] *Geschichte der Kugel-, Walzen- und Rollenlager,* 56 S., 46 Abb. Schweinfurt a. M., Präzisions-Kugel-Lager-Werke FICHTEL und SACHS, [1914]. 1918

History of ball- and rollerbearings illustrated from the most important sources. The fruit of the collaboration between a great industrial concern and a great historical expert. When will the British and American business men follow this remarkable example? There is a bibliography but it is to be regretted that the illustrations are not identified with more precision. G. S.

Feldhaus, F. M. *Modernste Kriegswaffen, alte Erfindungen.* 240 S., viele Abbild. Leipzig, ABEL und MUELLER, [1915]. 1918

An heterogeneous collection of 139 short papers dealing with the history of arms and of other tools. Chiefly anecdotic, this book will appeal to the antiquarian rather than to the historian. It is useless as a reference book because of the absence of index and table of contents. G. S.

Feldhaus, Franz M. Die Geschichte der Schleifmittel. Mit einem Anhang von H. FRIEDERICH. 83 S., 49 Abb. Hannover-Hainholz, Vereinigte Schmirgel- und Maschinenfabriken Aktien-Gesellschaft, 1919. 1813

A very complete history of polishing from prehistoric times until the middle of last century, with remarkable illustrations. The appendix deals with various polishing substances (emery, corundum, « Korubin », silicon carbide). G. S.

Fischer, Hermann. Beiträge zur Geschichte der Werkzeugmaschinen. Schmiedemaschinen. *Beitr. z. Gesch. d. Technik u. Industrie*, t. VI, p. 1-34, 54 Fig. Berlin, 1915. 1813

Häusser, Friedrich. Keltern einst und jetzt. Aus der Technik der Weines. *Beitr. z. Gesch. d. Technik und Industrie*, t. VII, p. 127-133, 6 Fig. Berlin, 1917. 1813

Hennig, Richard. Beiträge zur älteren Geschichte der Leuchttürme. *Beitr. z. Gesch. d. Technik u. Industrie*, t. VI, p. 35-54, 5 Fig. Berlin, 1915. 1813

Notes on beacons in ancient and mediæval times down to the xixth century. G. S.

Hennig, Richard. Beiträge zur Geschichte der Aeronautik. *Beitr. z. Gesch. d. Technik u. Industrie*, Bd. 8, 100-116. Berlin, 1918. 1813
Down to the time of LEONARDO DA VINCI. G. S.

Horwitz, Hugo Theodor. Beiträge zur aussereuropäischen und vorge-schichtlichen Technik. *Beitr. z. Gesch. d. Technik u. Industrie*, t. VII, p. 169-189, 34 Fig., Berlin, 1917. 1813

Johannsen, Otto. Die Quellen zur Geschichte der Eisengusses im Mittelalter und in der neueren Zeit bis zum Jahre 1530. 2te Fortsetzung. *Archiv für Gesch. d. Naturw.*, t. VIII, p. 66-81, 1917. 1813
See *Isis*, t. III, p. 153.

Moll, F. Die Entwicklung des Schiffsankers bis zum Jahre 1500 n. Chr. *Beitr. z. Gesch. d. Technik u. Industrie*, Bd. 9, p. 41-52, 5 Taf. Berlin, 1919. 1813

The development of anchors abundantly illustrated : pl. I contains 41 types taken from Greek coins (vith cent. n. c. to 1st cent. after CHRIST); pl. II, 54 types from Roman coins (iurd cent. n. c. to iud. cent. after CHRIST); pl. III, 60 mediæval types (vuth to xvith cent.); pl. IV represents actual remains of ancient anchors and anchors as drawn on the Bayeux tapestry; pl. V, 42 more types of Christian times. Bibliography.

Stickelberger, Emanuel. Versuch einer Geschichte der Gerberei. 95 p., 36 illustr. Berlin, Springer, 1915 [not seen]. 1813

Vogel, Walther, Geschichte der deutschen Seeschifffahrt. I. Bd. Von der Urzeit bis zum Ende des xv. Jahrhunderts, xvii + 560 p. Berlin, REIMER, 1915. 1818

Wettich, Hans. Die Maschine in der Karikatur. Ein Buch zum Siege der Technik. 216 S., 260 Abb. Berlin, EYSLER, 1920. 1818

A large collection of drawings and cartoons of technological interest. Some of the illustrations are borrowed from MSS. or early printed books, the greatest number however are taken from nineteenth cent. or contemporary magazines. Special chapters are devoted to lifting-gears, wind-mills, suspension railways, ordinary railways, bicycles, automobiles, electric and magnetic-machines. The two last chapters deal with fantastic machines and machines as represented in commercial posters. A but too short conclusion is entitled : Machine in Art. G. S.

Wreden, Richard. Vorläufer und Entstehen der Kammerschleuse, ihre Würdigung und weitere Entwicklung. *Beitr. z. Gesch. d. Technik u. Industrie*, Bd. 9, p. 131-168, 24 Abb. Berlin, 1919. 1818

Die Vorläufer der Schifffahrt mit Schleusen. — Der ältere Schleusenbau Holland (oldest reference to a canal lock, dated 1155 ; oldest mention of a lock for shipping, 1243). — Der Uebergang von der einfachen zur doppelten Stauschleuse als Vorläufer der Schleppzugschleuse in Deutschland (locks about as ancient in Germany as in Holland). — Der Uebergang von der einseitig (unterhäuptig) geschlossenen Muschelschleuse (*conca*) in Italien zur Kammerschleuse (oldest Italian date, 1188 ; the first *conca* is mentioned in 1420 ; L. B. ALBERTI's improvements 1452 ; LEONARDO DA VINCI, before 1497, completes the system), etc. Elaborate bibliography. G. S.

35. — ZOOLOGY

Bouvier, C. L. La vie psychique des insectes (Bibliothèque de philosophie scientifique). 299 p. Paris, FLAMMARION, 1918. 1818

Dultz & Co. Evertibrata. Vererbungslehre. Hierin die Bibliothek des Herrn Prof. Dr. R. SEMON in München und ein Teil der Bibliothek des Herrn Prof. Dr. A. GOETTE in Strassburg, Antiquariats-Katalog 39, 61 S. München, Landwehrst., 6. 1921. 1818

1485 items of which only 83 deal with the theory of evolution. G. S.

Gilliéron, Jules (1854-). Généalogie des mots qui désignent l'abeille, d'après l'Atlas linguistique de la France, 360 p. Paris, CHAMPION, 1918. 1818

Joleaud, L. Revue de paléontologie animale. *Revue générale des sciences*, t. XXXI, p. 487-500. Paris, 1920. 1818

Survey of the progress made in 1917, 1918, 1919. G. S.

Kelling, K. Der Hund im deutschen Volkstum. Seine Stellung und Bedeutung in Sage, Sitte, Brauch, Glaube und Sprache unseres Volkes. 83 p. Neudamm, J. NEUMANN, 1914. 1818

Laufer, Berthold. The story of the Pinna and the Syrian lamb. *Journal of American folk-lore*, t. XXVIII, p. 103-128, 1915. 1818

Mennessier de la Lance, général Gabriel René (1835-). Essai de bibliographie hippique donnant la description détaillée des ouvrages publiés ou traduits en latin et en français sur le cheval et la cavalerie avec de nombreuses biographies d'auteurs hippiques. 2 vol. Paris, DORPON, 1915-1917. 1819

Thayer, Gerald. Concealing-coloration in the animal Kingdom. An exposition of the laws of disguise through color and pattern : being a summary of ABBOT H. THAYER's disclosures. With an introductory essay by A. H. THAYER. New ed. with a new preface. xvi col. pl., 140 fig., 4°, XIX + 260 p. New York, MACMILLAN, 1918. 1818

This book relating the observations and experiments of the great American painter A. H. THAYER, 1849-1921, was first published in 1909. It explains the theory of counter-shading (THAYER's Law, 1896), and the obliterative properties of some of the most gorgeous animal costumes. It gave a scientific basis to the practice of *camouflage* which took such importance during the war. Many admirable illustrations. G. S.

ERRATA

Vol. II, p. 306, read Stratz, C. H. (Carl Heinrich) instead of Stratz, O. H.

Id. p. 439, under Jacopone da Todi, read Biordo Brugnoli instead of Rrugnoli.

Vol. III, p. 25, note 4, read Daniel Sennert instead of De Senner.

Id. p. 26, read Nicolas de Blegny, instead of Bligny.

Id. p. 29, note 2, read Cornelis Bontekoe instead of a Bentekoe.

Id. p. 24, read Thomas Willis instead of Ph. Willis.

Id. p. 320, under Gossen, Johannes read 1907, not 1917.

Id. p. 320, read Schütte instead of Sehütte (the same mistake occurs in the index).

Id. p. 503, l. 3, read III, 496.

Id. p. 504, Under **Index of Authors**, read,
to Volumes II and III.

Id. p. 550. Add PELSENEER, P., III, 467.

For previous errata, see vol. II, p. 480; vol. III. p. 155, 503.

ISIS

International Review devoted to the History
of Science and Civilization.

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of No. 11 (Vol. IV, 2)

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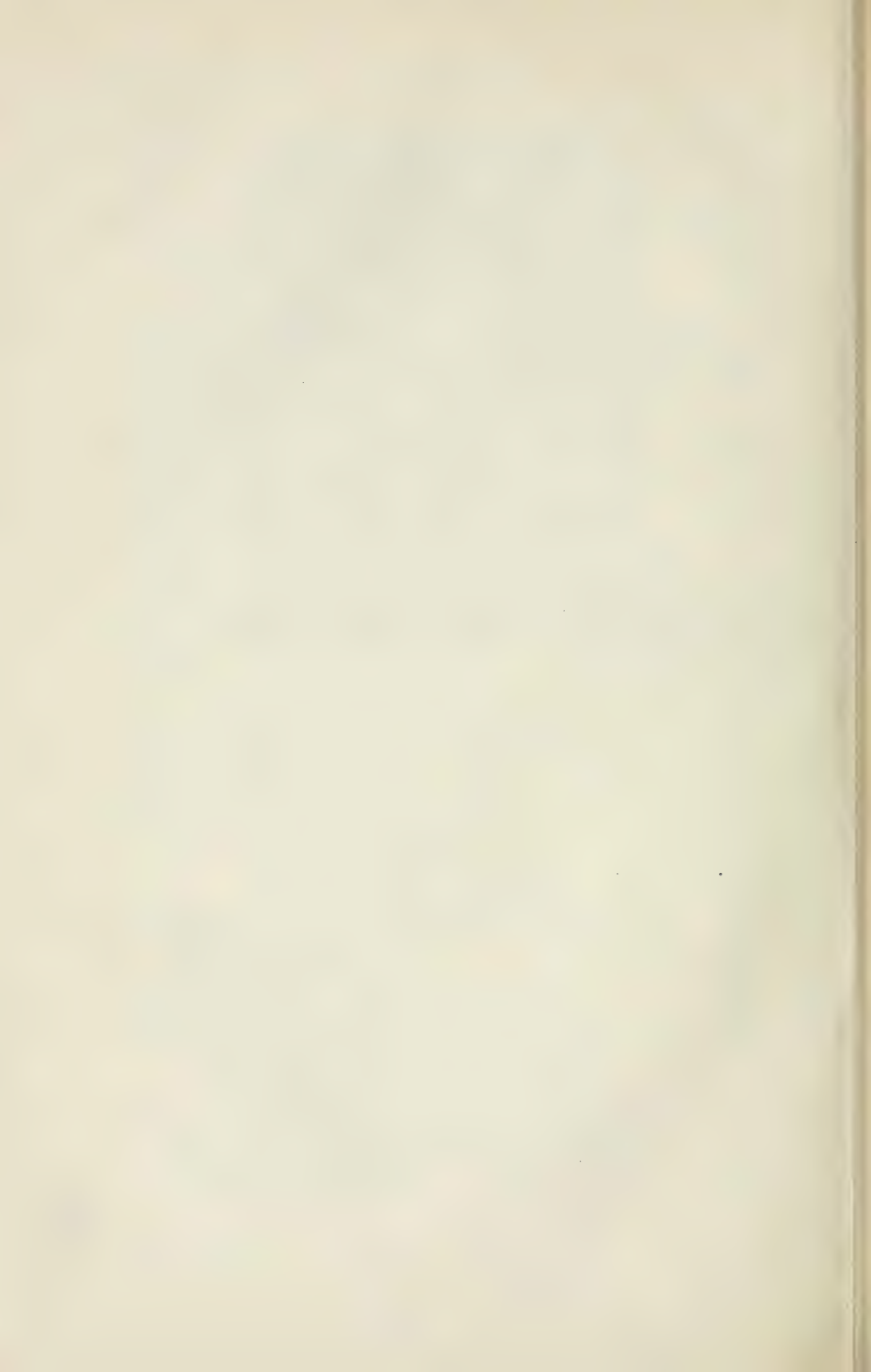
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The Teaching of the History of Science

(Second article) (1)

What is the present status of the teaching of the history of science in European and American universities? The lists and announcements of courses which have been published in various journals (2), may give the reader a very misleading impression. For these lists are many and some are quite long, but most of it is mere bluff. For example, many such courses have been extemporized in America. But, with one exception (CAJORI), I do not know of any course delivered by a lecturer having the rank and emoluments of a professor and devoting himself exclusively to it. To be sure, some of these courses offered as a « side show » by scholars whose main business is to study and to teach something totally different, may be very interesting. Among others, the lectures which the physiologist L.-J. HENDERSON has been giving at Harvard since 1911 have been eminently successful. This exception does not prove anything. Nor does BERTHELOT's example prove that it is generally possible to pursue simultaneously experimental and historical investigations with any considerable success. We owe some of the best work in every field to the capricious efforts of *dilettanti*, but we can never depend upon them and we must of necessity expect the main advances in knowledge to be made by men whose sole duty is to make them and who give their every thought to it. The case of HERMANN GRASSMANN is particularly strange. About 1852, being then in the forty-third year of his age and probably discouraged by the cold reception of his *Ausdehnungslehre* (first published in 1844, it

(1) The first essay, bearing the same title, appeared in the *Scientific Monthly*, September 1918, vol. VII, p. 193-211. The present paper does not supersede the first one, but completes it.

(2) By ENESTRÖM in the late *Bibliotheca Mathematica*; by SUDHOFF and GÜNTHER in the *Mitteilungen*, by MIELI in his *Archivio*, by F. E. BRASCH in *Science* and by myself, though rarely, in *Isis*.

remained practically unknown for twenty years!), he turned his attention to Oriental studies, and he conquered fame as a Sanscrit scholar before being recognized as one of the greatest mathematicians of his day. It does not follow from this that it would be wise to intrust Vedic exegesis to mathematicians, or *vice versa* to expect the Sanscrit instructor to offer, as an additional attraction, some lectures on higher algebra or vectorial analysis. To expect a professor of history or science who is not specialized in the history of science to give a course on this subject is equally foolish. Yet this sort of foolishness or wickedness is becoming very common, for every university seems now anxious to add some course on the history of science to its program, though none is willing to pay the price of it.

This is in itself sufficient to prove that the signification and peculiarities of such courses are not yet understood, even by those who organize them. To form some idea of the present status of this teaching it will be better not to consider the number of courses offered, nor to enumerate the lecturers, for we should risk being deluded. We will consider only such courses as are offered year after year by specialists and which are placed on the same academic footing as other fundamental studies. Let us ask, first of all, how many chairs are devoted to the history of science? The brevity of the answer will be a sharp contrast with the length of the make-believe lists to which I previously alluded.

In America, I do not know of any chair devoted to the history of science proper, but FLORIAN CAJORI is professor of the history of mathematics at the University of California. Of other positions enabling the incumbent to cultivate these studies with relative freedom from material care, I know only the one which was founded for me in 1918, by the Carnegie Institution of Washington. If I am not mistaken, that is all for the New World!

Matters are hardly better in the Old World, at least so far as the history of science proper is concerned. I know of only one chair dedicated to it, the one at the Collège de France, which is now occupied by PIERRE BOUTROUX (1). Mr. BOUTROUX wrote me a few months

(1) His title is "professeur d'histoire générale des sciences". (While correcting the proofs, I hear that ABEL REY is now "professeur d'histoire de la philosophie dans ses rapports avec les sciences" at the Sorbonne, but that is another subject, as I have shown in my first paper.)

ago that for some time to come his lectures will deal with the history of the principles of mechanics. His chair is the very one which poor COMTE had vainly tried to have established, but which was not founded until 1892, thirty-five years after COMTE's death, and intrusted to PIERRE LAFFITTE. In 1903, the latter was succeeded by G. WYROUBOFF instead of PAUL TANNERY, who was obviously the right man. If TANNERY and later DUHEM had been appointed to it (it appears that political prejudice was the only obstacle to their nomination), this chair would have behind itself the noblest tradition imaginable; but it was not to be. Let us hope that PIERRE BOUTROUX is now inaugurating a new tradition which may make us forget the brilliant opportunities which were lost in the past.

The chair of the Collège de France is to-day the only one in the world devoted to the history of science. It is true, EDMOND GOBLOT of the University of Lyons bears the title of « professeur d'histoire de la philosophie et des sciences », but the emphasis is laid on philosophy, not on science, and GOBLOT's own work is chiefly in the field of logic (1). I should mention as being in the same line the course offered at University College, London. ABRAHAM WOLF is in charge of it with the title of professor of logic and scientific method. His own work is also exclusively in the field of logic (2). Short courses on the history of science have lately been organized under his direction (3), but as I am dealing here only with regular and permanent courses and not with makeshifts, I can not consider them.

The situation is even worse than it seems at first sight, if one remembers how many chairs are devoted to historical studies. In the latest Harvard catalogue (1920-1921), I find that not less than thirty-five members of the faculty are primarily engaged in historical teaching of some sort, the history of science alone being excluded. There are thus in the world thousands of professors of history, but only one of them is teaching the history of science! Shall we weep or laugh? The history is taught of everything under the sun, except science; yet we call this age of ours, the age of science! A moment's reflection will convince anyone that the only human activity which is truly

(1) *Isis*, III, 306.

(2) I know two books of his: *The existential import of categorical predication*, Cambridge 1905, and *Exercises in logic and scientific method*, London, 1919.

(3) *Isis*, III, 419.

cumulative and progressive is scientific activity, — the acquisition, accumulation and transmission of knowledge. The only conquests which are final are our conquests over ignorance. Thus any history of humanity should be focussed upon the progress of knowledge; that should be the thread, the *leitmotiv* of the human epos. Yet that very part of our annals is either ignored or treated in such offhand and scandalous fashion that complete silence would be more reverential.

I have spoken thus far of the history of science in general. The situation is better with regard to special sciences or groups of sciences. CAJON's teaching at Berkeley has already been mentioned. The chair of Heidelberg has been made famous for ever by the late MORITZ CANTOR (1). There may be, at least in Germany, a few other chairs devoted to the history of mathematics. It is in the medical domain, however, that historical studies have been organized in the most elaborate manner. The Institute for the History of Medicine founded at the University of Leipzig by the munificence of TH. PUSCHMANN has become, under the direction of KARL SUDHOFF, one of the greatest historical institutes in the world. There are also historico-medical institutes and chairs at the University of Vienna (MAX NEUBURGER) and Jena (TH. MEYER-STEINER) and there may be still others: I have quoted those which are, and justly so, the best known. I do not know of any chair for the history of medicine in any other country, though lectureships are fairly common. At one time (1863-1891), ANGELO CAMILLO DE MEIS (2) was professor of the history of medicine in Bologna, but he was never replaced.

The privileged status of the history of medicine calls for some explanation. How shall we account for it? For one thing, the history of medicine has always attracted far more attention than the history of other sciences or techniques, because of its intensely humane character. Try as you will, the history of the medical art can never be divested of its human element. The average man is more likely to be interested in the riddles of disease and death, which confront him at every step, than in the principles of geometry or mechanics. This interest will easily take an historical turn, for the solution of riddles evokes anecdotes; men are naturally fond of anecdotes, and anecdotes belong to the past. On the other hand, the clinical and historical points of view have something in common and

(1) He has been succeeded by KARL BOPP.

(2) *Isis*, IV, 421.

the physician is perhaps more tempted than any other scientist to delight his well-deserved leisure with historical research. This explains why the literature of medical history is so enormous and also why so much of it is rather of an inferior quality, — more in the nature of anecdote, gossip and idle antiquarianism than of philosophical history.

The most important feature of the history of medicine, however, is that it is, in fact, far more comprehensive than its name would suggest. Textbooks on the history of medicine are not by any means restricted to medical topics; they deal as well with anatomy, physiology, botany, even to a certain extent with chemistry, arithmetic, astrology, etc. For the mediaeval period down to the xvth century, some of these histories might be passed off as histories of science. At any rate, physicians are generally ready to take them as such, for they are not philosophically minded, they hate abstractions, they ignore the more exact sciences and are satisfied that the history of medicine gives them all that is really worth knowing of the history of science.

Thus did it come to pass that the history of medicine, — having considerably enlarged its natural scope and received a sufficient elaboration at a comparatively early date, — filled the needs and gratified the curiosity of a large part of the students who might have become interested in the history of science proper. From this point of view it may be said that the earlier and greater success of historico-medical studies has temporarily impeded the progress of our own. At all events, this does not matter much, for whatever historical research was done by historians of medicine either in their own or in neighbouring fields, *is* done. They have helped to develop methods which can easily be extended to similar investigations with regard to other sciences, they have created model institutions which it will not be difficult to render more comprehensive, they have awakened an historical interest which may be progressively diverged to the broader sphere. And whatever errors of interpretation were due to their peculiar point of view, their onesidedness and their ignorance, will be easily righted in the course of time.

To appreciate properly the present situation of the teaching of the history of science, it will be well to compare it with that obtaining in other historical departments comparable to it, chiefly the history of art and the history of religion. A comparison with the latter is particularly apposite, and I will come back to it presently. As to

the former, its situation is incomparably more favorable. There is no college, I am sure, that has not at least one chair devoted to the history of art. In the larger colleges a whole department is devoted to art, though the greatest part of its activity is naturally absorbed by practical rather than historical subjects. But this teaching suggests another comparison. We have seen that the history of medicine has to a large extent supplanted the history of science proper. In the same way, the history of the so-called « fine arts » has superseded the history of art to such a degree that the average man very often mistakes the former for the latter. This comparison should not be carried too far, however, because the situations of both cases are reversed. The history of the more abstract and the purer kind of art has drawn most of the attention, while the applied or decorative arts have been comparatively neglected. On the other hand, it is the applications, chiefly the medical applications, of science that have first engrossed the historian's interest, at the expense of the more abstract disciplines. To put it more briefly, man's historical curiosity has been (and is still) arrested primarily by the highest forms of art and the lowest forms of science.

II

A comparison with the history of religion is extremely instructive, for the present status of our studies is very similar to its own some fifty years ago. Before that time the history of religion had been considered by the theologians and the educated public either with undisguised disfavour, or (and this became gradually the more common attitude) with that polite indulgence which one readily grants to curious but futile investigations. When the first courses were organized, it was thought that almost any theologian could prepare them, an assumption which was the further from the truth in that at that time scientific textbooks on the subject were not yet available. The first good textbooks appeared only at about the end of the last century (1). The first chair devoted to the history of

(1) CORNELIS P. TIELE, *Geschiedenis van den godsdienst tot aan de heerschappij der wereldgodsdiensten*, Amsterdam, 1876 (English translation, London 1877). — CHANTEPIE DE LA SAUSSAYE, *Lehrbuch der Religionsgeschichte*, 2 vol., Freiberg, 1887-1889. The second edition prepared by CHANTEPIE with

religion was established in Lausanne in 1871. Then followed in quick succession : Genève and Boston, 1873; Oxford (Manchester College), 1876; Groningen, Leyden and Utrecht, 1877; Amsterdam and Upsala, 1878; Paris (Collège de France), 1880; Brussels, 1884 (1). In 1870, there was not a single chair of the history of religion, and the scientific and systematic study of this subject had not yet begun. Thirty-four years later, in 1904 (2), there were scattered all over the world not less than thirty chairs, and the history of religion had become solidly established as an independent discipline, having its own methods and instruments, its own traditions. The days of chaos were past; it was no longer believed that anyone could study — not to say, teach — the history of religions without special training; museums and schools had been founded, and their doors were carefully guarded.

The reader will readily forgive me for having spoken of the history of religion at a greater length than he would probably expect in an essay on the history of science, for could anything give us more courage and inspiration than this brief history of a discipline so closely related to our own?

In 1870, the history of religion did not exist; to-day, it is safe to say that at least one chair is devoted to it in every university or seminary worthy of the name.

This preamble makes it easy to explain my own ambition. We are starting almost from the point whence the TIELES and the CHANTEPIES started fifty years ago. We must emulate them and exert ourselves to such an extent that fifty years hence the faculty of no university or college will be deemed complete if one at least of its members be not exclusively engaged in the study of the history of science.

I am writing this in the autumn of 1921. I am ready to fight for

the assistance of a few other scholars (1897, French translation 1904, third German edition 1905), was probably the first satisfactory textbook, though it did not include Christianity.

(1) It is interesting to note that small nations like Holland and Switzerland took the lead. Holland's credit is particularly great because the teaching of the history of religion was from the beginning in the hands of masters: TIELE in Leyden and CHANTEPIE in Amsterdam. The first incumbents in Paris and Brussels were respectively ALBERT RÉVILLE and GOBLET D'ALVIELLA.

(2) My information is derived chiefly from LOUIS HENRY JORDAN, *Comparative religion. Its genesis and growth*, Edinburgh, 1905.

this cause and I will not retire alive from the arena until I have won (1). I will not lay down my arms if at least twenty chairs devoted to our studies do not exist by the year 1941, — and if there be not at least fifty of them by the year 1971, I will not hesitate to jump out of my grave and fight all over again.

The history of religion has been established as an independent discipline during the last quarter of the past century; it is our sacred mission to establish the history of science as an independent discipline during the second quarter of this century. We must work so hard and so well that other scholars will be obliged to recognize the independence and the fundamental importance of our studies; we must elaborate and systematize the necessary methods and instruments; we must create traditions which enforce obedience, discourage amateurish efforts and render unskilled teaching unthinkable.

It is also our particular duty of the moment to make it clear to university presidents, deans and other authorities that, if the teaching of American or Greek history is considered as a man's job, *a fortiori* the teaching of the history of science must be. For in the first case there are excellent textbooks, dictionaries, and various other intellectual tools; the subject has been studied from every angle; the main points have been emphasized and the moot questions discussed over and over again; the teaching itself is well-nigh standardized. In the second case, there are only numerous and often conflicting monographs written by various scholars in many languages; there are no exhaustive textbooks (2) and the instructor is left to find and clear his own way in the bush. It is our duty to hammer into their heads the conviction that to intrust the teaching of a new subject to non-specialized scholars and especially to those who have already other scientific obligations and can devote only a small part of their time to the new ones — is a joke and a very bad one at that. And when they do so it is our duty to proclaim their foolishness, their incapacity, and to give them generously all the discredit and ridicule which bad educators and ignorant administrators fully deserve.

(1) To avoid any misunderstanding, I hasten to add that I have personally no wish to become a professor. *Sic ego non mihi...*

(2) FR. DANNEMANN'S book is satisfactory as far as it goes, but it is elementary (*Isis*, IV, 110).

III

It is useless to discuss the teaching of the history of science if one has not thoroughly understood the double origin, the double nature of this discipline. Its name is sufficiently significant, but one often overlooks the obvious. The *history of science* is a historical discipline; it is also a scientific discipline. The historian of science must have a sound knowledge of two sets of facts: historical facts and scientific facts. He must be familiar with the methods required to ascertain and to interpret these two kinds of facts. It would serve him little to be a good scientist, if he had no historical sense, no historical training; it would serve him less to be a well-trained historian if he had no understanding, no knowledge of science.

To make this clearer, let us consider again the branches of learning more comparable to our own: the history of art and the history of religion. If the historian of religion were deprived of religious feeling and religious experience, he would be doomed to make capital blunders at every step. His learning would be but dead and senseless pedantism; it would be worthless. The case of the historian of art is even more manifest: of what use would it be to him to know the names and dates of the old masters if his heart did not understand their silent voices? The art critic who has not himself the temperament of an artist is doomed to failure. He may know all the details; he is unfit to understand the essential.

In the same way, the historian of science who does not grasp the scientific facts and theories (it does not generally suffice to know the definite facts in question; one must be able to grasp whole series of related facts and to seize the trains of thought involved by them), who has no scientific experience and feeling, is bound to make essential mistakes, irrespectively of his learning. Historical and scientific errors must be equally avoided, but many historical errors are only venial offences, while the scientific errors are deadly sins. The former, indeed, imply merely a misapprehension of the accessory circumstances, while the latter prove that the very substance of one's investigations has not been understood. Imagine a teacher explaining to his audience the theory of homocentric spheres. He might fail to introduce it properly, and the lack of historical perspective would unduly increase Eratosthenes' fame at the expense of

his predecessors; this would shock us but we might forgive him. Imagine now that his historical account be perfect but that he proves his inability to understand the theory itself. What confidence could we have in him? When the fundamental facts are wrong (and in our case, these are the scientific facts) we do not even care to know whether the historical circumstances are right or not.

One may object that those who deal with mediaeval or oriental science do not need as much scientific knowledge. That is true but only to a certain extent. It is true enough, for instance, that we owe some of the best work on mediaeval science to historians who had not received any scientific training. Such exceptions do not prove anything, and we must remember on the other hand that the two greatest students of mediaeval science of our time are (or were) professional scientists: KARL SUDHOFF and the late PIERRE DUHEM. It is obvious that their work could not have been done by laymen. Besides, the field of mediaeval science gives us but too many examples of erudite research vitiated by scientific ignorance. A common source of error is the confusion between mediaeval and modern terminology, and the extension to the former of connotations of a much later date. This applies particularly to studies on Hindu science. Finally, I must point out that there is a great difference between learning and teaching. A mediaeval scholar without scientific training may yet carry on investigations of great value, for if he be prudent enough to avail himself of expert advice he will easily avoid the scientific pitfalls. He may thus produce excellent papers and yet remain unqualified to teach mediaeval science, for he could not appeal to his scientific adviser in the course of a lecture, and a teacher must be able to give additional elucidations and to answer troublesome questions.

I hope that my emphasis upon scientific errors will not be misconstrued. If I were to say that killing a man is a worse offense than cheating at cards, this would not mean that I condone cheating. There is a hierarchy of sins, there is a hierarchy of errors. When I say that, for the historian of science, scientific errors are generally mortal, I do not mean that historical errors are of no importance. We must try to avoid them by all means. Historical facts are valuable only to the extent that they are accurate; it would be foolish to collect worthless material. Our ideal of historical truth can never be placed too high.

IV

Granted the priority and essentiality of scientific facts, it follows that the historian of science, especially the one engaged in teaching, should be primarily a scientist and secondarily a historian, a philosopher. There is another reason, hardly less cogent, why his training should be primarily scientific. This is the well-known fact that scientific knowledge, and even more so, scientific methods and points of view, must be assimilated while one is young; that is the more true that the sciences considered are more abstract. In the extreme case of mathematics, it may well be said that he who has not studied them before he was twenty or twenty-five will never be able to master them, for he will never again find the time nor have the persistent and docile energy which are needed to complete such systematic training. The same might be said of experimental work; experimental habits must be made in youth; we can not fully understand the experimental spirit unless early practice has caused it to impregnate our own substance (1).

On the other hand, historical training, difficult as it is, can be eventually undertaken later. The true historical spirit is innate rather than acquired. And as to historical understanding, it can but increase as we gain more knowledge of the world, more experience of life. Children cannot possibly understand history; they misunderstand it systematically. Indeed, there are many historical facts which can not be appreciated except in the maturity of one's age, when personal experience has revealed the true meaning of human passions, when one has been able to measure their violence with one's own heart. It takes many storms to make a good sailor. For example, familiarity with the political conditions of one's own day will help one to judge the political problems, the political passions and crimes of the past. Thus the older one becomes, the better does one understand political history, — and history in general.

One must also take into account the extreme interdependence of scientific facts, the rigorous concatenation of scientific theories,

(1) It is for these reasons that I advise young students interested in the history of science to study as much mathematics and carry on as much laboratory work as they can. It is for them a matter of now or never.

which makes it generally far more difficult to understand isolated facts or theories than is the case in the historical domain. One unfamiliar with physics and chemistry will be unable to read with any profit a book on spectroscopy, while he will find no essential difficulty in reading and following the history of Ethiopia even if his previous knowledge of the subject, and of history in general, is very small.

I think we may now consider as proven that early and thorough scientific training is the prime qualification of the historian of science. The next question is then naturally, what should be the extent of this training? To be ideal it should be encyclopaedic. Such training is not at all unrealizable, but the number of people having undergone it is of necessity very small (not because of any insuperable difficulty, but simply because of a lack of organization, because it is not « done »; I will come back to this presently) and we must take into account existing conditions. We must frankly admit that if the teaching of the history of science were suddenly organized on a large scale — if, say, ten chairs were established at once — it would be well-nigh impossible to find men fully qualified to occupy them. That would be no serious obstacle, however, for it would be much easier to find scholars ready to teach the history of one science or group of sciences, and the more general teaching might be temporarily replaced by a more special one. It is in the nature of things that the first teachers, the pioneers, are inferior to the later ones, even though their inspiration be of a higher quality. Our best works are nothing but stepping stones for our followers.

It would be unwise to insist at once upon the necessity of an encyclopaedic training, but there are minimal requirements which should be satisfied in any case. It would be unadvisable, for instance, to intrust such teaching to men having no experimental training whatever. This training can not be obtained simply by the making of artificial experiments — such as those prepared for the students in college laboratories — the results of which are known beforehand. It is necessary to have made at least a few genuine experiments, experiments in the unknown. A minimal knowledge of mathematics should also be required (except for those restricting themselves to the history of medicine), and this minimum should include at least some familiarity with analytic and synthetic geometry and infinitesimal calculus. For without such knowledge it would

be impossible to speak tolerably (1) of such men as ARCHIMEDES, APOLLONIUS, DESCARTES, HUYGENS, NEWTON, LEIBNIZ and EULER, and a course on the history of science containing no account of them would be very much like the play of HAMLET without HAMLET.

Keeping these minimal requirements in mind, one could rightly expect the teacher to be able to expound the whole history of science down to the beginning of the last century (with more emphasis on the subjects he knows best and a more superficial account of the others). He should not be expected to explain the latest developments except of those sciences with which his special training has caused him to become more familiar.

Courses on the history of science should have the same flexibility as courses on the history of art or religion. The teacher to whom the latter are intrusted should not necessarily be expected to devote as much attention to every religion or sect or to every phase of their development. If he were an Arabic scholar, he would be justified in giving relatively more time to Islam and thus letting the students share the fruits of his studies, or else a bent to ethnography might induce him to treat more fully the more primitive stages. A professor of art might be more interested in painting and (after due warnings to his audience) there would be little harm in his neglecting relatively the other arts to lay more emphasis on the history of painting. In this case, however, he would be frequently obliged to deal with the other branches of art merely to explain the development of his favourite one. In the same way, the historian of science could never neglect too much any branch of knowledge, for the evolution of every branch is simultaneous and none is independent of the others. It is impossible to understand the development of any one science without reference to the others. Even then, the professor of the history of science should remain unusually free in the selection and the treatment of his subject. Administrators should always be ready to sacrifice programs to personalities. They should never forget that the presence of a real scholar in their midst is an inestimable blessing. Even if he be a poor teacher, his very presence

(1) I do not say *to explain* their work, for this would require a far deeper knowledge of mathematics. For example, a very sound knowledge is indispensable to explain the development of Greek mathematics and astronomy. A knowledge of elementary geometry is not at all sufficient to interpret EUCLID.

is an inspiration. There are hundreds of good teachers for one original and complete scholar.

To be more specific, we might divide roughly all scientists into three groups : biologists and naturalists; physicists (including chemists and astronomers); and mathematicians. If the training of a prospective teacher had been chiefly biological, he might be expected to teach the history of science down to about 1800, with special emphasis on natural science and biological problems. He might give also a course on the history of biology down to our time, a course which would naturally culminate in a discussion of the main problems of our day and possibly in a vision of the future. In his general course, he should be allowed to skip over the mathematical subjects, though it should be made clear to him that he would improve his qualifications by a certain amount of mathematical study. In a similar way, the physicist would become a far better teacher of the history of science if he would study some biology. The best for him would be to spend his summer vacations in a biological station, like Naples, Wimereux, Roscoff or Woods Hole, where he could pleasantly divide his time between investigations along the beach and rocks, interviews with his expert colleagues, and microscopical or experimental work in the laboratory. The case of the mathematician may be more difficult. The pure mathematician — I mean the one with no experimental training and a marked predilection for the more abstract subjects — should not attempt to teach the history of science, though he might be able to give an interesting course on the history of logic and mathematics. The average mathematician, however, has received some training in experimental physics, and is interested in various applications. He might become an excellent teacher of the history of science, if he would spend his vacations in a biological station, undertake if possible some experimental research and take advantage of every opportunity to visit laboratories, workshops and mills. He should indulge in frequent discussions with engineers and inventors. They would gradually inculcate on him the difference between mathematical possibility (the absence of internal contradiction) and practical possibility. He should be made to realize it repeatedly in different ways and he should learn also to distinguish the many degrees of possibility and the conditions of each.

To sum up, the only unqualified scientist is the lopsided one, he whose knowledge is abnormally developed in a single direction and

who has lost touch with the rest of science (it is hardly necessary to point out his disability to him, for he is depressingly aware of it, but he will seldom admit the qualifications of others!). Of the specialized scientists, none is better prepared than the biochemist, if he has received a good mathematical and physical training. For his own speciality is located, so to say, at a strategic point; he has learned to appreciate the cardinal problems of many sciences. But even to him we should prefer the scientist who, after a long training both theoretical and experimental, has chosen for his life-work the study of general science — we might call him the specialized encyclopaedist. His particular training makes it much simpler for him than for any other scientist to observe the life and analyze the congruity of science, to watch its increasing unity amidst innumerable changes, to follow the growth of the tree of knowledge and of every one of its branches, to survey with comparative ease either the total knowledge of any one period or the evolution of some special science throughout the ages.

V

The historical method has been so often used in elementary and popular handbooks that to many people the phrase « history of science » conveys vaguely the meaning of « introduction to science ». The misunderstanding has been aggravated in America by the organization of courses on the history of science, which are professedly introductory. Their aim is to offer to the students at the beginning of the curriculum a sort of bird's-eye view of the whole of science in order to facilitate their choice of a proper direction.

There is little doubt that the historical method is excellent for that purpose. It is also the most natural one. Each man must somehow retrace the whole evolution of his ancestors. The historical method consists in replacing him in the psychological status of early man and in making him retrace step by step, though more rapidly, the intellectual progress of mankind. This method is extremely pleasant and suggestive, and it is remarkable how much knowledge can be imparted by its means to an intelligent audience. However, its limits are very quickly reached. The journey already accomplished by man is so immense that, even if one avails oneself of all the historical short cuts, the advance made possible by this method is too slow

and precarious. It is soon found necessary to use other methods which are almost the reverse of the chronological one. One starts from the latest notions instead of the most primitive, and one readily reconstructs the edifice of knowledge without reference to the accidents of discovery. In both cases the progress is from simplicity to complexity, but in the historical method the elements are simple by their concreteness, in the synthetic method they become simpler by increasing abstraction.

The use of the historical method is limited not simply by the lack of time, but also because as soon as one needs more than a bare outline, it becomes unmanageably complex. It is not possible to teach a subject and its history at one and the same time. The best method (one which every author has been gradually led to follow) is to give at first a brief historical outline which awakens the student's curiosity and makes it easier to define the field and the purpose of the science one is dealing with; then to abandon the historical order altogether and teach the subject in a systematical manner; finally to teach the history of the subject, thus enabling the student to review his knowledge from a different point of view and to deepen his understanding of it. The last stage — the true historical one — is frequently omitted, because its importance has not yet been fully realized and because the practical needs of the student are satisfied at the end of the second and he generally lacks the disinterested curiosity and the enthusiasm which are necessary to go any further.

Certain « introductory » courses written along the historical method (MACH's mechanics is the best example) are as simple as they are deep, but this simplicity is rather deceptive. At least the meaning of such books is disclosed only to those who have already a thorough knowledge of the subject. One encounters the same fallacy with regard to other elementary books. A summary is relatively richer in facts and meaning than a complete textbook, but the profit that we can derive from it is strictly dependent upon our memory of all the substance which it represents. The complete and seasoned scholar may find much to please and instruct him in a good elementary book, but it would be foolish to imagine that the same book will be equally instructive for an apprentice. Where the latter can but see a curious, if not a repellent, skeleton, the master will evoke at a glance the flesh and life around the dry bones. It takes a wise man to understand a primer.

When I am speaking of the history of science, I am not thinking of these historical introductions; it is hardly necessary to worry about them. The teaching I am thinking of is, on the contrary, a sort of conclusion to be offered only to advanced students, in their last year. It should be to them, before their departure from the college, the supreme humanistic initiation. It would involve a sort of synthetic review of their studies. They would have taken courses in science, in literature, in art, in history. This final course on the history of science would reveal to them the interrelations of all these parts, it would show them that they are but fragments of a single whole; it would expose to their view the magnificent harmony, the congruity, the unity of knowledge.

As I said a moment ago, an attempt has been made in some universities to offer such a course at the beginning of the curriculum, but it is then necessarily restricted to vague generalities and, even so, how much of it do the students understand? I think it is wiser to place it at the end, for a good deal of intellectual experience and maturity is needed to benefit by it: this teaching will be the more pregnant to each student that he has already acquired more knowledge.

Indeed, knowledge bears interest like money; the richer one is, the easier it is to get richer still; the more and better one knows, the easier it becomes to increase and improve one's knowledge. It is encouraging to realize, for example, that because of the unity and consistency of science, it is possible to understand its development much beyond one's own direct experience, that is, provided one's initial knowledge be sufficient and of good quality. If a student has taken the pains to carry on investigations along a certain line, and if he has conducted genuine experiments — experiments followed by frequent deceptions and perhaps finally rewarded by the discovery of a new fact, however humble — he will easily understand the meaning of other experiments not simply in the same field, but even in totally different ones. For the elements of experimentation are essentially the same in every field, and the most complicated and forbidding apparatus are made up of elements which are relatively simple and belong to a relatively small number of types. The same can be said of scientific method in general. An intelligent scientist can understand and appreciate the work of fellow scientists, even of those who are engaged in research widely different from his own. A

sound scientific initiation is indispensable to such understanding, but it does not matter so much which. This comparison might even be pursued outside the sphere of experimental science. Let us again consider the history of religion, for example. It is clear that a scholar who has made a deep study of the development of one religion will find it relatively easy to understand the vicissitudes of another, for the human motives and the psychological problems involved are essentially the same in every clime.

As far as the scientific aspect of this teaching is concerned, it is hardly necessary to press the point: one's interest in the history of a thing can but increase as one becomes more familiar with it. The advantage of late instruction is not less obvious from the historical point of view, though a course on the history of science and civilization (that is, a history of civilization focussed upon the progress of science) can be made very interesting to an audience having but little knowledge of history. I have made the experiment more than once. I have lectured on Greek science and civilization, for instance, to boys whose whole past — whose living past — was at most two centuries deep: the depth of a skin. Yet I managed to entertain them and they entertained me too, for such ingenuity is not without charm. I prefer, however, to lecture to more sophisticated people, who have already obtained some sort of historical background and a sense of perspective. It is a great pleasure to be able to reveal to them that the history with which they are already familiar is not by any means the whole story, and to make them realize gradually that the history of mankind is double: political history which is to a large extent a history of the masses, and intellectual history which is largely the history of a few individuals (1).

The first development is the obvious one; it is the one which has thus far claimed the attention of historians almost exclusively. The peoples of the earth and, within each nation, the different classes of men, are not equally fertile, ingenious, energetical, ambitious. Their ambition — in the case of peoples one calls it, often, imperialism — is a function of their strength and vitality. If they become conscious of their superiority without being restrained by moral or religious motives, they are bound to become aggressive. Between strong, numerous, hungry people on the one hand and effeminated

(1) For further development of the same idea, see my essay on *Secret History*, *Scribner's Magazine*, vol. 67, p. 187-192. New York, 1920.

people, weak, scarce and replete on the other, there arises, so to say, a difference of potential which, if it reaches a certain limit, causes a sudden disruption, — war or revolution. Political or economic history can thus be explained in terms of forces chiefly material. (At least in theory, for in most cases the complexity of causes is too great to admit of a strict analysis, and we must be content to register most historical disruptions as we register earthquakes or cyclones : we know the causes, but only in a general way, and our hold on them is very weak.) To be sure, other factors than the material must be considered — moral and religious factors, for instance, — but the fundamental causes are material. Leaders may exert a deep influence and modify the course of events, but only to a limited extent, for their energy remains always a function of the energy of their following. They can lead only to the extent that they avail themselves of existing passions, of the differences of potential which already obtain : they can not create these differences, but they can make use of them in various ways ; they can delay the discharge or else provoke it and modify its nature.

The second development is far less obvious ; in fact, so far as the majority of people is concerned, it is almost secret. Yet it is the development of the activities which are most specifically human, the development of all that is best in humanity : I mean the development of art, of science, of justice, of moral and religious ideals ; in short, the creation and evolution of spiritual values. These values are created by individuals ; in most cases, isolated individuals. CAESAR and NAPOLEON can not accomplish their destiny without the collaboration of millions ; SPINOZA, NEWTON, PASTEUR do accomplish their own in seclusion. They thrive best in solitude. The elaboration of their sacred task — the very fulfilment of human destiny — is to a large degree independent of circumstances. At least, external circumstances seem purely accidental, not really creative. Society can poison SOCRATES, crucify JESUS or behead LAVOISIER ; it can not cause them to be born, it can not dictate their task.

It is, as I said, a very great pleasure to reveal to a young audience this second but essential aspect of human history — the very course of human progress — for they know generally but little of it, and what they know has been obscured by the large mass of irrelevant and indifferent facts. They see kings enthroned, peoples in arms ; they hear the clash of armies or of mobs ; they may even hear the

impassioned orations of statesmen or rebels. But how could they see the poor philosopher working in his miserable garret; the artist wringing under the load of his inspiration; the scientist pursuing silently, obstinately his self-imposed quest? It requires more wisdom and imagination than they can possibly have to see these things. But they may know pretty well the historical background. It is then the estimable privilege of the historian of science to place in front of it the small but central figures.

Of course when the history of science is more generally known a greater place will be given to it in the regular courses of history, but even then the supreme historical teaching will have to be delayed until the end of the studies; it will remain a conclusion, not an introduction, for the reasons which I have already set forth.

As I see it now, historical teaching will proceed in the following way: the first teaching will be primarily political and economic; that is, the teacher will paint the background first. In later stages he will then introduce gradually the central figures and he will bring them out more distinctly as the knowledge and experience of the students increase: — the artist, the seer, the thinker, the scientist, the saint.

This order is the natural one. We must expect young students to be interested chiefly not in our highest but in our most primitive activities. Our deepest motives are centered upon such primal matters as food and shelter; love and hatred; business and play; health, disease and death. Besides, it is the abnormal conditions, not the normal ones, which excite the greatest curiosity. One needs the cold language of statistics to describe normality with any accuracy; but abnormalities are always sufficiently conspicuous; they need no barking at the door; they oblige us all to pause. It is not peace and plenty, therefore, but war and famine which interest the people most; not sanity, but insanity; not health, but diseases and plagues; not the soundness of love, but its perversions and irregularities. And the cruder the people, the more eager is their concern in monsters and oddities: the publishers of the yellow press know it full well. I will readily confess that when I am myself too tired to study or meditate, I have still enough energy to read the newspaper's gossip. That is, when my better self is exhausted, I can still draw upon the more primitive curiosity which is dormant at the bottom of my heart. All this explains why it is the conven-

tional history (one might call it the pathological history of humanity) which interests man first and most.

It is thus better perhaps not to quarrel with the old-fashioned historian : let him do as he is wont and give the people what pleases them most. They like to hear of wars and revolutions, of kings and princesses. They love the pageantry of the past, the pageantry and the scandals. Let them have them ! That is the background of the picture; they will have to know it at any rate, why not first ? There can be no objection to that, but we have a right to insist that some historical course, revealing the essential and putting matters in their true perspective, be given at the end of the curriculum. This would be the supreme humanistic initiation. And I add : let the historian of science do it, for he alone who is equally familiar with science and history, is fully qualified to explain the true nature of human progress.

VI

The history of science is an encyclopaedic discipline. It will stand or fall as we accept or not the possibility of encyclopaedic knowledge. I claim that such knowledge is both necessary and possible (1).

It is necessary as a coördinating and harmonizing agency; the very progress of special research would become more difficult without it. It remains possible because the increasing extension and complexity of science are largely compensated by its consistency and its progressive unification. To deny the possibility of encyclopaedic knowledge is almost as foolish as it would be to say that it is impossible to draw a geographic or geological map of the world. And yet such maps are being drawn, and they were already drawn a long time ago, when our geographical knowledge was considerably smaller than it is now. It is necessary to do it periodically, each time that science has reached a higher level, in order to inventory our knowledge, to determine more exactly our ignorance and to guide and ease further advance. To every stage of the progress of science there corresponds a stage of encyclopaedic knowledge which is, so to say, the image or the map of science at that particular time. The gaps of our knowledge are no obstacle to it : they are simply

(1) I have developed this point in my paper on HERBERT SPENCER, *Isis*, III, p. 375-386. 1921.

the blank places, the *terrae incognitae* of the map, and nothing is more inspiring to the future explorer than to see them there and then in their proper relations to the better-known territories.

Encyclopaedic knowledge is not necessarily more difficult to obtain than any other. Nor is it necessarily vaster than any specialized knowledge, for its elements are different. There are as many names on the map of Massachusetts as there are on the map of the world, but they are names of a different kind. It is true, encyclopaedic knowledge requires special qualities; it is hopeless to attain it unless one be endowed with a synthetic intelligence. But that is equally true of any occupation: it takes a collector's mind to collect insects, at least to do it well; it takes a computer's mind to prepare a table of logarithms. It is easy enough if you have the right brains; it becomes impossible if you have not.

Encyclopaedic knowledge is relatively rare, not because of its difficulty, but rather because very few attempt to obtain it, or, if they do, do it in the right way. There is no tradition to help one, there are no traced roads to follow, and one can not become an encyclopaedist as passively as one becomes a physician or an electrical engineer. Yet the increasing specialization of knowledge will sooner or later make it imperative to create professional coördinators (1).

To quote a single example, it would not be unreasonable to expect university presidents to be encyclopaedists. It is true that under present circumstances (2), they have so much administrative work and so many social duties (outside of the faculty) that the training of a diplomat or of a banker may suit them better, and that they need entree more than knowledge. However, as the administrative burden increases it will soon be necessary to divide the intellectual and the administrative functions, and the more so that they are essentially different. This may be the best way to check the progressive industrialization of American universities (3). There must

(1) For the sake of concreteness, I propose to publish in an ulterior paper the outline of a complete curriculum. A course of seven years would be quite sufficient for anyone having already received a solid secondary education, such as is obtainable in a French *lycée*.

(2) It is the American conditions which I have particularly in mind in this paragraph.

(3) Of course this is partly caused by their tremendous growth. Every living creature has an optimal size. It is likely that there is also for each institution

be some coördinating agency between the members of the various faculties, and the coördination must be of the highest order; mere administrative coördination is almost worthless beyond its own limited range. The president to whom the intellectual leadership would be intrusted would need possibly an encyclopaedic education, and in any case a scientific one. Some fifty years ago it was assumed that a college president could be chosen only from among the theologians. Fifty years hence the presence at the head of a great institution of learning of a man having no other training than a literary or legal one, will appear as incongruous as that of a minister would now, and for the same reason. It will be generally assumed that the head of such an institution must have a minimal understanding of the activities over which he is expected to preside. Literary men, of course, will maintain that they do not lack that understanding, for few of them have yet realized the seriousness of their ignorance. But the plain, if unpleasant, fact is this: there can not be complete reciprocity between the literary man and the scientist, for the latter can understand the former, while the former can not understand the latter. Imagine an assembly of men who are supposed to deliberate and work together: one third can speak but English, another third can speak but Latin, and the rest are versed in both languages. Would it not be wiser (*ceteris paribus*) to select the leaders in the third group? I give this comparison *faute de mieux*, but it is unsatisfactory, for it is far easier to translate from one language into another than to impart a scientific attitude to one who has no scientific experience. The encyclopaedic training would be the ideal one for a college president and for any man whose scientific duties are not specialized.

VII

The organization of courses on the history of science like those I am dreaming of — not introductory, but rather retrospective —

an optimal size, beyond which it can not remain a *live* institution. But this abnormal growth is itself a symptom of industrialism. With the exception of a very few colleges (notably Princeton, Dartmouth, Bryn Mawr) the proportion of applicants who are refused admission is exceedingly small. It would benefit the Great Republic more to have fewer students and better universities. (Conclusions based upon figures published in the *New York Times* of Oct. 16, 1921).

would have far-reaching consequences. It would be the wedge by means of which encyclopaedic studies and the encyclopaedic point of view would gradually penetrate into our universities. It is partly because of this that I insist so much upon the history of science as against the histories of particular sciences. Such special histories are, to be sure, interesting enough, and their study should be encouraged to insure a deeper understanding of the science concerned; indeed, from the purely scientific point of view their interest is very great, but none of them can possibly have the same educational, humanistic bearing as the history of science. The progress of civilization is a function of the growth of knowledge in general, not of any special kind in particular. Besides, the evolution of each science is dependent in many ways upon the advance made by the others.

From this point of view, it should be remarked that the teaching of the history of science will not be simply one more teaching added to so many others, but will have a synthetic and coördinating value the importance of which can not be overestimated. Of course, this synthetic value will depend very much upon the personality of the teacher. But I am so convinced of its importance that I would fain say that the teaching of the history of science must be of a synthetic nature, or else that it does not deserve to exist.

But that is not all. The whole historical teaching will be gradually influenced by the history of science. Even if it be found expedient to leave to elementary teaching a purely political and pathological character (that is, if, as I now believe it, it is thought best to paint the background first), even then historians will be gradually impressed with the need of a scientific training. They will cease to be purely men of letters; driven between the archaeologists on the one side, and the historians of science on the other, their traditional ignorance of science will no longer be for them a matter of jest or boast, but a matter of shame. We have already attended a similar evolution with regard to geography. When I was a child, teachers of geography were literary men; their transformation into scientists has taken place so rapidly that before long a literary geographer will be as rare as the dodo. It is now generally understood that a sound knowledge of the structure of the earth, and of the soil, the meteorological conditions, the minerals, the plants and animals of each climate, is the natural introduction to geographical studies. That is, geology, meteorology and natural history are now considered as the

foundation of geography. Before the end of this century it will seem equally obvious that only those who are able to understand the elements of human progress are entitled to teach its history. The historical seminaries will then contain laboratories and small collections of natural history (as mementos!) and it will be recognized that for the average historian some knowledge of science is far more essential than a knowledge of heraldry or sigillography : the necessity of scientific propaedeutics will be generally accepted.

A good example of such preparation was given a long time ago by my dear master, EDWARD GIBBON. I quote from his autobiography this most interesting fragment (1) :

« After a short holiday, I indulged my curiosity in some studies of a very different nature, a course of Anatomy which was demonstrated by Dr. HUNTER, and some lessons of Chemistry which were delivered by Mr. HIGGINS : the principles of these sciences, and a taste for books of Natural History, contributed to multiply my ideas and images, and the Anatomist or Chemist may sometimes track me in their own snow. »

GIBBON did not pursue his scientific studies beyond this preliminary stage, yet he had clearly understood their importance, and scientists will have now one reason the more (if they did not know of it) for admiring him. If all historians took as much pains to approach the scientific point of view as GIBBON did, there would be less ground for complaining of their onesidedness, and the chasm between them and the scientists would not be quite as deep as it is.

The history of science will be the channel through which science will gradually penetrate into a system of education from which it has been thus far jealously excluded. It is through it that the humanizing value of science will first be felt. But well may the conservative hesitate to introduce it into the curriculum, for it will slowly but surely call forth a radical transformation of the whole system, a transmutation of educational values. The historians of science will constitute the vanguard of the New Humanism.

Cambridge, Massachusetts,
October 1921.

GEORGE SARTON.

(1) The *Autobiographies* of EDWARD GIBBON edited by JOHN MURRAY. London, 2nd ed., p. 315, 1897. The fragment quoted refers to December 1777 ; GIBBON was then forty years old ; the first volume of the *Decline and Fall* had appeared the year before.

Michael Scot and Frederick II

In any judgment respecting the scientific activity of the court of FREDERICK II, much depends upon the opinion formed of MICHAEL SCOT, the emperor's astrologer, whose writings form a large part of the scientific and philosophic product of the *Magna Curia*. Condemned by ROGER BACON as « ignorant of the sciences and languages », SCOT is praised by GREGORY IX for his knowledge of Hebrew and Arabic, and addressed as *summe philosophe* by LEONARDO PISANO, the most eminent mathematical genius of his time. Naturally enough for an astrologer, SCOT early became a subject of legend, and the small body of fragmentary fact has not yet been winnowed from the mass of tradition. The elaborate biography by Dr. J. WOOD BROWN (1) contains far too much of pleasing conjecture, and its insecure chronology has misled more than one subsequent writer. It may help investigation if we try to set down the ascertainable events of SCOT's life and to group his works in some chronological order, as a preliminary to an examination of his treatises on astrology and his intellectual relations with the emperor.

Concerning the place and date of SCOT's birth no evidence has reached us. We may, however, be sure that when Master MICHAEL calls himself SCOT (2) he means a native of Scotland and not an Irishman, as the name frequently signifies in mediaeval usage. Not only did he hold benefices in Scotland (3), but he refused a most lucrative appointment, the archbishopric of Cashel, because he was ignorant of the Irish tongue (4). That he knew English appears

(1) *An Enquiry into the Life and Legend of MICHAEL SCOT* (Edinburgh, 1897); followed closely in the article in the *Dictionary of National Biography*.

(2) « Cui ego MICHEL SCOTTUS tanquam scottatus a multis et a diversis » : Bodleian. MS. Canon. Misc. 555, f. 45; infra p. 270. « Ego MICHAEL SCOTUS » : JOURDAIN, *Recherches sur les traductions latines d'ARISTOTE* (Paris, 1843), p. 127-129; MS. Pisa 11, on p. 252, below.

(3) BLISS, *Calendar of Papal Letters*, I, p. 102.

(4) *Ib.*, I, p. 98.

from a list of Anglo-Saxon names of months which he inserts in his *Liber introductorius* (1). The facts of his career place his birth somewhere in the late years of the twelfth century. Of his education we know nothing, the statements concerning his studies at Durham, Oxford, Bologna and Paris being mere guesses of modern writers. All that we can say is that his writings show a knowledge of the elements of Latin culture — the Bible, AUGUSTINE, the writers on the *trivium* and *quadrivium* — and that this was probably gained before he went to Spain for more special studies.

We must likewise dismiss as entirely baseless Dr. BROWN's chapter which makes SCOT tutor of the young FREDERICK II and author of various works composed in Sicily in 1209 and 1210. The sole foundation for this elaborate construction is the misreading as « MCCX » of the « MCC etc. » of a Vatican codex of the *Abbreviatio AVICENNE* (2); and there is no evidence connecting SCOT with Sicily until many years later.

The first specific date in SCOT's career is 18 August 1217, when he completed at Toledo his translation of AL-BITRODJI (ALPETRAGIUS) *On the Sphere* (3). He had plainly been for some time in Spain and

(1) *Nomina mensium secundum Anglicos*. Primus mensis anni Anglorum est giuli, id est januarius; 2. est solmonath, id est februius; 3. est heredemonath, id est martius; 4. est turimonath, id est aprilis; 5. est thrumiei, id est maius; 6. est lidan; 7. est lydi; 8. est vendmonath; 9. est aligmonanh; 10. est gyh. Hee gentes suum annum incipiunt a medianocite nativitatis Domini et quociens sunt kalende mensium tociens solempne pulsant campanas ecclesie maiori post complementum officii matutini cum interpolatione et omnes gentes summa devocione vadunt ad eandem ecclesiam portantes aliquid ad offerendum. Cod. Lat. Monacensis 10268, f. 71v.

(2) See the facsimile in BROWN, p. 55. Monsignore AUGUST PELZER of the Vatican Library informs me, as I had conjectured from the facsimile, that « MCC etc. » is the necessary reading of the original. I find that Sir JOHN SANDYS had also questioned BROWN's reading, but without rejecting the inferences from it (*History of Classical Scholarship*, third edition, I, p. 566).

(3) JOURDAIN, *Recherches*, p. 133, where one Ms. has the Christian and one the Spanish era. This is confirmed by MS. Madrid 10053 (ca. 1300, formerly in the chapter library at Toledo), f. 156v.: « Perfectus est liber AVENAL. AVENALPETRAUG a magistro MICHAELE SCOTTO Toleti in decimo octavo die veneris augusti hora tertia cum ABUTEO levite anno incarnationis Jesu Christi 1217 ». MS. BARBERINI Lat. 156 of the Vatican, f. 194, has 1221, but with the same day of the week and month. STEINSCHNEIDER, in Vienna *Sitzungsberichte*, CXLIX, p. 57 (1904), gives incorrectly 1267. Cf. MS. ARSENAL, 1035.

gained something of that acquaintance with Arabic which was to serve him later. The next point in Scot's biography is 21 October 1220, when he appears at Bologna, living in the house of the widow of ALBERTO GALLO and giving a medical consultation on a neighbor's case of calculus (1). The sworn note to this effect which he appends to certain copies of the *De animalibus* gives the year as 1221, but the day of the week given shows that he is using the Pisan style, as in his later works (2). This is his first appearance in Italy, and it should be remarked that FREDERICK II was in the neighborhood of Bologna at the same time (3), although we have no evidence that Scot was then in the emperor's service.

From 1224 to 1227 the papal registers show that Scot had the active favor of Pope HONORIUS III and his successor, GREGORY IX. This interesting series of entries begins 16 January 1224 with a letter from HONORIUS III recommending Scot to the archbishop of Canterbury as a man of eminent learning (*singularis scientia inter alios litteratos*), worthy of a benefice in that province (4). The church assigned yielded an insufficient income, and 18 March he received permission to hold two benefices (5), one of which appears from what follows to have been in England. His tenure of these was unaffected by his elevation the following May to the archbishopric of Cashel (6), but by 20 June he had declined this preferment because of his ignorance of Irish (7). 9 May 1225 he is allowed to hold an additional benefice in England and two in Scotland (8). 28 April 1227 GREGORY IX, shortly after his accession, urges MICHAEL's claims on the archbishop of

(1) The note is printed by Dr. M. R. JAMES in the *Catalogue of the Manuscripts in the Library of GONVILLE and CAIUS College*, I, p. 112, from MS. 109. It is also found in a XIIIth century copy of the *De animalibus* in the manuscripts of the Convento S. CATERINA at Pisa, MS. 11, f. 133-133v (cf. *Studi italiani di filologia classica*, VIII, p. 325), where the following is added to Dr. JAMES' text: "eiecit in octabis sancti JOHANNIS maiorem post. VIII. dies post minorem."

(2) Below, p. 266.

(3) BÖHMER-FICKER, *Regesta Imperii*, Nos. 1176-1194.

(4) PRESSUTTI, *Regesta Honorii Pape III*, No. 4682; *Chartularium Universitatis Parisiensis*, I, No. 48; BROWN, p. 275; BLISS, *Calendar of Papal Letters*, I, p. 94.

(5) PRESSUTTI, No. 4871; BLISS, I, p. 96.

(6) PRESSUTTI, No. 5025; not in BLISS.

(7) PRESSUTTI, No. 5052; BLISS, I, p. 98.

(8) PRESSUTTI, No. 5470; BLISS, I, p. 102.

Canterbury as one who had pursued learning since boyhood and added a knowledge of Hebrew and Arabic to his wide familiarity with Latin learning (4).

In 1228, or, since we are in Pisa, more probably in 1227, falls the dedication to SCOT of the revised edition of the great treatise of LEONARDO PISANO on the abacus, of which SCOT had solicited a copy from the author (2). As LEONARDO was in relations with FREDERICK II and the philosophers of his entourage as early as 1225 or 1226 (3), SCOT may have already become connected with the emperor's court. In any event, SCOT disappears from the papal registers after 28 April 1227 and no long time can have elapsed before he joined the court of FREDERICK II with which he is thereafter identified. Contemporaries call him FREDERICK's astrologer and recount various stories of his skill, even to the prediction of the place of the emperor's death (4), while SCOT himself mentions instances of his prophesying from the stars the results of FREDERICK's military operations (5). SCOT's later works are dedicated to the emperor, and one of them, the *Abbreviatio AVICENNE*, was kept in the emperor's library in 1232. The loss of the imperial registers, save for a fragment of 1239-1240, prevents our tracing details of his activity at the court, except for some indications in SCOT's own writings to which we shall come below.

If we could accept the statement of a note which accompanies this prophecy in one manuscript, SCOT was at Bologna in 1234, where he was consulted by the *podestà* and notables concerning the fate of the Lombard cities and replied with a famous set of verses predicting the fate of each. The references to the events of 1236 and following are,

(1) AUVRAY, *Régestes de GRÉGOIRE IX*, No. 61; *Chartularium Universitatis Parisiensis*, I, No. 54; POTTHAST, *Regesta*, No. 7888; BLISS, I, p. 117.

(2) BONCOMPAGNI, *Scritti di Leonardo Pisano* (Rome, 1857), I, p. 1; for the date 1228, see BONCOMPAGNI in *Atti dei Lincei*, first series, V, p. 73 f. (1851); CANTOR, *Vorlesungen über die Geschichte der Mathematik*, II, p. 7.

(3) *Scritti*, II, p. 253. On the chronological difficulties, see ENESTRÖM, in *Bibliotheca Mathematica*, IX, 72f. (1908).

(4) SALIMBENE, ed. HOLDER-EGGER, p. 353, 361, 512, 530; RICCOBALDI of Ferrara, in MURATORI, *Scriptores*, IX, col. 128; FRANCESCO PIPINI, *ib.*, IX, coll. 660, 670.

(5) "Et ut apercius hec dicta pateant, recordamur duarum questionum inter alias principis volentis ire super duas civitates sibi rebelles", followed by the observations, with diagrams, and SCOT's deductions. *Liber introductorius*, MS. n. a. lat. 1401, f. 99v.

however, so specific as to indicate that this *Vaticinium* was written subsequently and ascribed to SCOT (1), who was known to have made definite predictions foretelling the emperor's triumph over his enemies (2).

The date of SCOT's own death is apparently fixed by certain verses of HENRY OF AVRANCHES dedicated to the emperor shortly before his last return to Italy from Germany early in 1236 (3). SCOT is here mentioned as one who has passed, apparently recently, into eternal silence, and there is no reason to doubt the testimony of a court poet then in the emperor's following. If we attach any weight to the Paris manuscript of SCOT's *Vaticinium*, he was in Germany with the emperor on this journey, and would thus have met his death there (4). The story ran that he was killed at mass by the falling of a stone, in spite of a metal headpiece by which he had sought to protect himself (5).

The only reason for seeking to place SCOT's death later is connected with the dates of his writings. The manuscripts of his *Liber particularis* bear a title *tempore domini pape INNOCENTII quarti* (1243-1254), and since the preface refers to an event of 1228 this cannot be explained away by BROWN as a slip for INNOCENT III; but, as there is no reference to this pope in the text, we may have no more than the guess of a scribe, itself inconsistent with a closing verse of 1256 (6). The commentary on the *Sphere* of JOHN OF SACROBOSCO must be subsequent to the date of that work, often stated as 1256, but the facts of SACROBOSCO's life have not been sufficiently investigated, and SCOT's authorship is too uncertain to permit drawing any decisive conclusion.

SCOT's writings are, with one exception, undated in the form in

(1) HOLDER-EGGER, in *Neues Archiv*, XXX, p. 349-377, where the text of the verses appears as well as in his edition of SALIMBENE, p. 361. Cf. WINKELMANN, *Kaiser FRIEDRICH II*, II, p. 323, n. A note in MS. lat. n. a. 1401, f. 124v., not used by HOLDER-EGGER, states that the verses were recited to the emperor by SCOT before the departure from Germany: DELISLE, *Catalogue du fonds de LA TRÉMOÏLLE*, p. 43.

(2) Poem of HENRY OF AVRANCHES: *Forschungen zur deutschen Geschichte*, XVIII, p. 486.

(3) *Ibid.*

(4) *Catalogue du fonds de LA TRÉMOÏLLE*, p. 43, cited above.

(5) PIPINI, in MURATORI, IX, col. 670.

(6) This verse is also found in the *Vaticinium* of JOHN OF TOLEDO: *Neues Archiv*, XXX, p. 353, note.

which they have reached us. They can, however, be distinguished into two main groups, corresponding to the two chief periods of his activity, the Spanish and the Sicilian. Speaking broadly, natural philosophy predominates in the earlier period, and astrology in the later. Let us consider them in this order :

(1) The only dated work is the translation of AL-BITRODJI, completed at Toledo 18 August 1217. This treatise, which develops ARISTOTLE'S theory of homocentric spheres against the eccentrics and epicycles of PROLEMY, was of considerable importance as a source of Aristotelian cosmology in the thirteenth century, and Scot's version seems to have been the medium through which it was known to ROGER BACON and others (1).

Scot's version of ARISTOTLE'S *Historia animalium* is in three of the manuscripts dated at Toledo (2). His authorship is clear from a memorandum inserted in his own copy and preserved in two extant manuscripts (3). This note, dated at Bologna 21 October 1220, shows that the work must have been completed before this date, and thus strengthens the statement that this version belongs to the Toletan period of Scot's life. As the manuscripts lack a dedication, the words *at Caesarem* added in current usage would appear to rest on a confusion with the *Abbreviatio* AVICENNE. Whether the translation was made from the Hebrew or from the Arabic has been a matter of dispute (4); in any event a Jewish interpreter (5) seems to have been used. The version is closely literal, so that it has even been used for reconstructing the Greek original (6); but there are also numerous errors, which were repeated by ALBERTUS MAGNUS in using it (7). Here, as in the usual Arabic tradition of the work, the *Historia*

(1) For the date and manuscripts, see above, p. 251; for the contents, P. DUHEM, *Le système du monde* (Paris, 1914), III, p. 241 ff. 327f.

(2) MERTON College, MS. 278; Cues, MS. 182 (GRABMANN, *Aristotelesübersetzungen*, p. 187); Laurentian, Plut. XIII, sin., cod. 9 (BANDINI, IV, p. 109).

(3) See above, p. 252, note.

(4) See especially WÜSTENFELD, in *Abhandlungen* of the Göttingen Academy, XXII, p. 101-106 (1877); STEINSCHNEIDER, *Die hebräischen Uebersetzungen des Mittelalters* (Berlin, 1893), p. 479-483.

(5) ROGER BACON, *Compendium Studii*, ed. BREWER, p. 472.

(6) RUDBERG, in *Eranos*, IX, p. 92ff.

(7) H. STADLER, *Albertus Magnus de animalibus* (Münster, 1916), I, p. XII; Id., in *Archiv für die Geschichte der Naturwissenschaften*, VI, p. 387-393 (1913).

animalium consists of nineteen books, including not only the *De animalibus historia*, with the spurious tenth book, but the *De partibus animalium* and the *De generatione animalium*. For all of these SCOT's version was the first and remained in use till the fifteenth century (1).

In the case of other works of ARISTOTLE the question is complicated by the fact that there was more than one version from the Arabic in circulation in the thirteenth century, as well as by their relation to the accompanying commentary of AVERROES. The one entirely clear case is the *De cælo et mundo*, to which SCOT has prefixed a preface addressed to STEPHEN OF PROVINS, a French ecclesiastic who is found in various documents between 1211 and 1231, in which year he is named by GREGORY IX as one of the commission to examine and purge the newly translated works of ARISTOTLE on natural science (2). This version is subsequent to 1217, as it cites the translation of AL-BITRODJI. It is altogether likely that SCOT is the author of the version of the *De anima* which, with the commentary of AVERROES, regularly accompanies his *De cælo* in the manuscripts (3). Translations of the *Physics*, *Metaphysics*, and *Ethics* have been ascribed to SCOT, but without sufficient evidence (4). The argument is somewhat stronger for certain other commentaries of AVERROES, coinciding as they do with SCOT's *Questiones NICOLAI* (5), but the matter is not yet clear. In any event SCOT's role was merely that of translator; it was AVERROES, *che il gran commento feo* (6)!

Two philosophic treatises of SCOT probably belong to the Spanish

(1) See in general, GRABMANN, *Forschungen über die lateinischen Aristoteles-übersetzungen des XIII. Jahrhunderts* (Münster, 1916), p. 185-187, and the literature there cited. This version passed quickly into use. Before ALBERTUS MAGNUS we find it cited by PHILIP DE GRÈVE, 1228-1236 (MENGENS, in *Philosophisches Jahrbuch*. XXVII, p. 28); and by BARTHOLOMEW ANGLICUS, ca. 1240 (GRABMANN, p. 42).

(2) JOURDAIN, p. 127f.; GRABMANN, p. 175; RENAN, AVERROËS (Paris, 1869), p. 206; bull of GREGORY in *Chartularium Universitatis Parisiensis*, I, No. 87. Another manuscript is at Erfurt, F. 351.

(3) HAURÉAU, *Philosophie scolastique* (1880), II, 1, p. 125; GRABMANN p. 198.

(4) JOURDAIN, p. 128, 141f., 144; GRABMANN, p. 172, 212, 215, 217. Note that the *Ethics* is cited in the preface to the *Liber introductorius* (see below), and the *Metaphysics* in the Commentary on SACROBOSCO.

(5) RENAN, AVERROËS, p. 205.

(6) DANTE, *Inferno*, IV, line 144.

period. One, a *Divisio philosophica*, or classification of philosophical knowledge, preserved only in fragments by VINCENT OF BEAUVAIS, is based in considerable measure upon DOMINICUS GUNDISALVI, who worked in Spain in the xiith century (1). The other, known in extracts as the *Questiones NICOLAI peripatetici*, is definitely assigned by ALBERTUS MAGNUS to SCOT (2), who here seems to take shelter in anonymity in order to preach strong Averroism (3).

(II) From the Sicilian period of Scot's activity we have, first of all, the *Abbreviatio AVICENNE de animalibus*, dedicated to FREDERICK II as emperor. We have already seen that this cannot be dated 1210 (4), as BROWN fondly thought; all that we can say is that it was anterior, and probably not long anterior, to the copy made from the emperor's original by HENRY OF COLOGNE at Melfi 9 August 1232 (5). FREDERICK'S keen interest in animals, and especially in birds, is a sufficient explanation of its origin (6).

The most ambitious of Scot's works belong to this period, the series of treatises on astrology made up of the *Liber introductorius*, the *Liber particularis*, and the *Physiognomia*. In their final form these are subsequent to 16 July 1228, since the general preface refers to FRANCIS OF ASSISI as already a saint (7). They are dedicated to the emperor, whom they mention in the text, and, as we shall see, contain in part answers to specific questions asked by him.

(III) The remaining works attributed to SCOT are more or less doubtful. The court of FREDERICK II became a peg on which to hang

(1) BAUR, DOMINICUS GUNDISSALINUS *De divisione philosophiae* (Münster, 1903), p. 364-367, 398-400.

(2) "Feda dicta inveniuntur in libro illo qui dicitur *Questiones NICOLAI peripatetici*. Consuevi dicere quod NICOLAUS non fecit librum illum sed MICHAEL SCOTUS, qui in rei veritate nescivit naturas nec bene intellexit libros Aristotilis." *Opera* (ed. Paris, 1890), IV, p. 697.

(3) HAURÉAU, *Philosophie scolastique* (1880), II, 1, p. 127; RENAN, *AVERROËS*, p. 209f.; DUHEM, *Le système du monde*, III, p. 245f., 339, 346f.

(4) *Supra*, p. 251.

(5) HUILLARD-BRÉHOLLES, *Historia diplomatica*, IV, p. 381.

(6) See my study of FREDERICK'S *De arte venandi cum avibus*, in *English Historical Review*, July, 1921.

(7) "Quandoque sine vestibus cum alis, ut seraphim ad beatum FRANCISCUM et MICHAEL quando pugnavit cum dracone et quando consignavit in Monte Gargano ecclesiam, propter quod dicitur Mons Angeli qui est prope Romam versus Apuliam." Munich, Cod. lat. 10268, f. 9v; N. a. lat. 1401, f. 22, omitting what follows "ecclesiam".

all sorts of fictitious attributions (1), and Scor's popular reputation could easily lead to connecting his name with the works of others. Such false ascriptions are particularly frequent in the alchemical literature of the ninth and ninth centuries, and until this has been more carefully sifted, it is safer to reserve the question of the specific alchemical writings which bear Scor's name (2). It is altogether likely that they have a genuine nucleus, indicated by the mention of Scor and Friar ELIAS in the text of the Corpus manuscript and by the knowledge of alchemy displayed in the passage from the *Liber particularis* printed below.

The commentary on the *Sphera* of JOHN OF HOLYWOOD has already been mentioned apropos of the date of Scor's death. No manuscript has been cited, and the only basis for ascribing it to Scor is the title of the printed edition (3). The preface shows some similarities of phrase to the preface to the *De arte venandi* of FREDERICK II (4), and the commentary recalls AL-BITRODJI (5); but there are no references to the emperor in the body of the work, and the scholastic style is quite unlike that of Scor's astrological writings, which are, indeed professedly popular. The treatise on geomancy ascribed to Scor in a

(1) CH. V. LANGLOIS, *La connaissance de la nature et du monde au moyen âge* (Paris, 1911), p. 190-192.

(2) BROWN, c. 4. E. VON LIPPMANN, *Entstehung und Ausbreitung der Alchemie* (Berlin, 1919), does not discuss Scor's alchemical writings, but only (p. 514, 680) his illustrations of the planets.

(3) "Eximii atque excellentissimi physicorum motuum cursusque syderei indagatoris MICHAELIS SCOTI super auctorem sperae cum questionibus diligenter emendatis incipit expositio confecta Illustrissimi Imperatoris Dni. D. FEDERICI precibus". I have used the Bologna edition of 1495 (HAIN, 14555) in the THATCHER collection in the Library of Congress.

(4) "Causa efficiens est magister JOHANNES DE SACROBUSTO et alii compositores. Causa finalis cognitio corporum celestium in se et proprietatum modus agendi est quintuplex, scilicet definitivus, probativus, id est probatitius, exemplorum positivus, ut legitime per se liqueat". *Ib.*, f. lv. So FREDERICK considers *intentio*, *utilitas*, and describes the *modus agendi* as "prosaycus, prohemialis, et executivus, executivus vero multiplex, partim namque divisivus, partim descriptivus, partim convenientiarum et differentiarum assignativus, partim causarum inquisitivus". Vatican, MS. Pal. lat. 1071, f. lv. The preface to Scor's *Liber introductorius* discusses *ars*, *genus*, *intentio*, *utilitas*, *finis*, *instrumenta*, etc. Clm. 10268, f. 16v; N. a. lat. 1401, f. 35. That of the *Liber luminis luminum* (BROWN, p. 81, 240) has *intentio*, *causa intentionis*, *utilitas*.

(5) DUHEM, III, p. 246-248, who accepts Scor's authorship.

late Munich manuscript is very doubtful (1), and the *Mensa philosophica*, at times attributed to him (2), is clearly by another and later hand.

Scot's translations were the occasion of unfavourable judgments on the part of ROGER BACON, who declared that Scot did not really know the languages or the sciences, and that the work was chiefly done by a Jew named ANDREW (3). Help of this sort was usually employed by the Toletan translators (4); whether MICHAEL was more inaccurate than others is a question which has not been investigated (5). On the other hand BACON seems to ascribe too much credit to Scot as the introducer of the natural philosophy of ARISTOTLE (6), for, as we have seen, only one of these treatises, the *De animalibus*, was first given to the Latin world by Scot. BACON's date 1230 has likewise been taken too literally, especially by those who have sought to connect it with the letter recommending the new versions of ARISTOTLE to the universities, a document once ascribed to FREDERICK II but now generally admitted to come from MANFRED, and to relate to the translations made at his court (7).

In general Scot's writings show a respectable education. He quotes the Scriptures freely and refers occasionally to AUGUSTINE and AMBROSE and more frequently to BOETHIUS, ISIDORE and BEDE. Classical Latin writers, such as VIRGIL, CICERO, and OVID, rarely appear. The citations from ARISTOTLE are fairly numerous; besides the *Metaphysics* and *De caelo* they include two references to the full text of the *Ethics*, then just coming into use in the West (8). There is

(1) Cod. lat. 489, ff. 174-206v (sec. XVI) : *Liber geomantiae* MICHAELIS SCOTI.

(2) As by QUERFELD, p. 12.

(3) *Compendium Studii*, ed. BREWER, p. 472; *Opus Tertium*, ed. BREWER, p. 91.

(4) ROSE, in *Hermes*, VIII, p. 332ff.

(5) Save in the case of the *De animalibus*; supra, p. 255.

(6) « A tempore MICHAELIS SCOTI qui annis Domini 1230 transactis apparuit deferens librorum ARISTOTILIS partes aliquas de naturalibus et metaphysicis cum expositionibus authenticis magnificata est philosophia ARISTOTILIS apud Latinos. » *Opus Majus*, ed. BRIDGETS, I, p. 55, III, p. 66.

(7) Document in HUILLARD-BRÉHOLLES, *Historia diplomatice*, IV, p. 383; *Chartularium Universitatis Parisiensis*, I, No. 394. Cf. BÖHMNER-FICKER, *Regesta*, No. 4750; GRABMANN, p. 201-203, 237, 249.

(8) « Ethica est scientia moralis quam reperitur compilavisse ARISTOTILES, cuius liber sic intitulatur, Ethicorum Nichomachiorum ARISTOTILES liber primus

no evidence of any real knowledge of Greek, the etymologies and the Greek names of months, climates, and points of compass being easily available at second hand; indeed it has been pointed out that in mentioning specifically Scot's knowledge of Hebrew and Arabic, GREGORY IX would hardly have omitted Greek if Scot had known this language. The extent of Scot's knowledge of Hebrew we are unable to judge, but he seems to have been in relations with JACOB ANATOLI, the translator of AVERROES and PTOLEMY (1). It may also be noted that the Arabic writers on astronomy and astrology whom Scot cites freely were in large part available in Latin versions of the twelfth century. His scientific writings show a knowledge of medicine (2), natural philosophy, and music, as well as a familiarity with the various branches of astronomy and its mediaeval applications. They deserve a closer examination than can here be given in relation to the astronomy and cosmology of his age.

Scot's writings on astrology were the basis of his literary fame in the Middle Ages, and it is by these that his scientific attainments must chiefly be judged today. The three treatises are introduced by a general preface, which he also calls an epilogue and which was hence written after the completion of the series (3). It is here clear that the three are parts of a single comprehensive work, and cross-references are frequent between the *Liber introductorius* and the *Liber particularis*. This general preface, which is long and diffuse, occupying thirty-eight pages in the principal manuscript, is largely given up to a loose discussion of the Creation — in the course of which the Averroistic doctrine of the eternity of the universe is

incipit; et sunt 10. libri cuius primus ita incipit, Omnis ars et omnis doctrina, etc. » Clm. 10268, f. 18v; N. a. lat. 1401, f. 37. « Unde ARISTOTILES in libro Ethicorum : desideratur res propter aliud. » Cod. lat. Mon. 10268. f. 16; MS. lat. n. a. 1401, f. 33v. The history of the Latin versions of the *Ethics* is treated by PELZER in the *Revue néo-scholastique* for 1921, p. 316-341, 378-400.

(1) RENAN, in *Histoire littéraire*, XXVII, p. 580-589; STEINSCHNEIDER, *Hebräische Uebersetzungen*, p. 58, 61, 523, 553. On contemporary Jewish culture in Sicily see further M. GÜDEMANN, *Geschichte des Erziehungswesens der Juden in Italien* (Vienna, 1884), p. 101-107; R. STRAUS, *Die Juden im Königreich Sizilien* (Heidelberg, 1910), p. 79-91.

(2) Cf. also the prescriptions which passed under his name : BROWN, p. 154f.

(3) Munich, cod. lat. 10268, ff. 1-19v; Bibliothèque Nationale, MS. n. a. lat. 1401, ff. 11-39; Edinburgh, MS. 132, f. 34. Cf. BOLL, *Sphæra*, p. 440, n.

specifically denied (1) — God, the Trinity, the nature of man, and the various orders of angels and evil spirits. The heavenly bodies are not the cause of the events which they indicate, but only the signs, as the circle before the tavern is only the sign of the wine within (2); but, granted an accurate knowledge of planets and the zodiac, we may know future events and the right occasions for doing anything (3). Indeed, we are later told that the astrologer need not err, by God's help (4). Sound learning (*mathesis*) is carefully distinguished from those magic arts (*matesis*) (5), which no Christian can rightly practise — geomancy, hydromancy, aeromancy, pyromancy, spatulamancy, necromancy, divination, auguries, incantations, prestigation, etc. The examples show that Scot was not unacquainted with these arts, as when, in the name of the Trinity, he gives an incantation for summoning the spirit FLORIGER (6). The list of magicians includes SIMON MAGUS, VIRGIL, PETER ALEXANDRINUS, the *ariolus* of ALEXANDER, and PETER ABELARD; to whom he elsewhere (7) adds SOLOMON and OTTONEL OF PARMA. The history of astrology is traced from ZOROASTER to GERBERT, via NIMROD, whose dialogue with IOANTON, illustrated with circles and figures, Scot has evidently seen and indeed uses in the body of the *Liber particularis* (8). From Egypt, where it was elaborated by King PTOLEMY, astronomical knowledge was carried to Spain by ATLAS, all before the birth of MOSES, and from ATLAS two French clerks brought the knowledge of the astrolabe in France to GERBERT, *optimus negrimanticus*, who by diabolical arts attained the archbishoprics of Reims and Ravenna and at last the papal see.

The last of the three treatises, the *Physiognomia*, may be dismissed

(1) « Ob hanc causam dicunt multi quod mundus sit ab eterno... et quod non sit mundus eternus patet aperte. » Clm., f. 1v; Nal., f. 11v. Cf. the commentary on SACROBOSCO, f. 2.

(2) Clm., f. 1; Nal., f. 11v.

(3) Clm., f. 15; Nal., f. 32v.

(4) Clm., f. 118v.

(5) *Ib.*, ff. 17-17v. So ROGER BACON, as in the *Secretum secretorum* (ed. STEELE), p. xxviii, 2f.

(6) Clm., f. 114v; not in Nal.

(7) Clm., f. 114v.

(8) See my article, « NIMROD the Astronomer », in the *Romanic Review*, V, p. 203-212 (1914). The figures of the Venetian manuscript deserve study; cf. p. 263, note 4 below.

with a word, as it has long been accessible in print and has been studied by FÖRSTER (1) and more recently by one of SUDHOFF's pupils, A. H. QUERFELD (2). Dedicated to the emperor, whom it professes to guide in his judgments of men, it contains a treatise on generation and an account of the prognostications from dreams, complexions, and the different parts of the body. Its indebtedness to the *Physiognomy* of the Pseudo-Aristotle is limited to the preface; it makes free use of RAZI, and shows some affinities with TROTULA and other SALERNITAN writers (3). There is also, possibly through a common Arabic source, some connection with the contemporary Latin version of the Pseudo-Aristotelian *Secretum secretorum* (4). The *Physiognomia* was much the most popular work of SCOT, having been printed in a score of incunabula and nearly as many later editions (5).

The *Liber introductorius*, consisting of four parts or distinctions, is SCOT's most ambitious work (6). It is written in more or less

(1) *De translatione latina Physiognomicorum quae feruntur ARISTOTELIS* (Kiel, 1884); *De ARISTOTELIS quae feruntur Secretis Secretorum* (Kiel, 1888); *Scriptores Physiognomici* (TEUBNER ed., 1893).

(2) MICHAEL SCOTTUS und seine Schrift *De secretis naturae* (Leipzig diss., 1919).

(3) FÖRSTER, *Scriptores*, p. XXIII-XXV, CLXXIX; QUERFELD, p. 20-23, 26.

(4) FÖRSTER, *Scriptores*, p. CLXXIX; ROGER BACON'S *Secretum Secretorum*, ed. STEELE (Oxford, 1920), p. XVIII-XXI, LXIII.

(5) QUERFELD, p. 14 f., who has also used the AMBROSIAN manuscript of 1256. I have used still another printed copy in the Harvard library, ca. 1490 (REICHLING, No. 1864), which is omitted from the *Census of Fifteenth Century Books owned in America*. The printed text lacks the chapters on urine, also copied as a separate treatise, which QUERFELD prints, p. 50-60; Italian version at Naples, Biblioteca Nazionale, MS. XV, F. 51.

(6) Munich, cod. lat. 10268, 146 folii, with notable figures, xivth century; Oxford, MS. BODLEY 266, a copy of the Munich manuscript (BOLL, *Sphæra*, p. 444); Paris, Bibliothèque Nationale, Nouv. acq. lat. 1401, ff. 39, 128v, probably copied in 1279 (DELISLE, *Catalogue du fonds de LA TRÉMOILLE*, p. 41-43); Escorial, MS. f. III, 8; modern copy at Munich, cod. lat. 10663. Extracts at the University of Edinburgh, MS. 132 (= Munich MS., ff. 118-146v); Bibliothèque Nationale, MS. lat. 14070, ff. 112-118v (= Munich, ff. 86v-89v); Vienna, MS. lat. 3124, ff. 206-211, MS. 3394, f. 214 ff. (SAXL, in *Der Islam*, III, p. 166); Vatican, MS. Pal. lat. 1363, ff. 90-94; MS. Pal. lat. 1370 (SAXL, in Heidelberg *Sitzungsberichte*, 1915, p. 25); MS. Vat. lat. 4087, ff. 88-99v; see also BROWN, p. 27.

None of these manuscripts seems complete. The Munich and Oxford codices lack the fourth distinction which cross-references show to have contained chapters

popular fashion (*leviter*) for beginners in the art of astrology (1), but is also intended for the convenience of adepts who may not have at hand the many works to which the author refers. It is not well organized, but the early portions are chiefly astronomical and the later astrological, the various heavenly bodies being taken up one by one and detailed advice given for the practice of the astrological art. The calendar is treated at some length, and there is a certain amount of meteorology, developed more fully in the *Liber particularis*. Emphasis is laid on the mystical value of the sevens which rule the world — seven planets, metals, arts, colors, odors, tones, etc. The music of the spheres leads to a digression on music, *de notitia totius artis musice*, which gives an outline of the whole subject, with citations of BOETHIUS and GUIDO (2). The astronomy is based chiefly on AL-FARGANI, with occasional citation of the *Almagest* (3), but the remarkable figures of the constellations and planets in the Munich and Oxford manuscripts represent an antique tradition which is ascribed by BOLL to the *scholia* of Germanicus (4). SCOT uses the Toletan tables, though he knows those of Arin and others. The astro-

De anima (Munich, MS. ff. 15, 88v), *De arte cyromantie*, and *De elementis* (MS. Canon. Misc. 555, f. 37-37v); they also contain later additions, as a table of 1320 (Munich, f. 76v) and a judgment of BARTHOLOMEW OF PARMA in 1287 (f. 125v). The Paris copy is earlier and considerably briefer, but includes the fourth distinction (ff. 105v ff., where the elements and the soul are treated). It ends (f. 128v): "Librum primum in arte astronomica incepimus in honore et laude Dei et ad preces domini nostri FREDERICI Rome imperatoris et semper augusti leviter composuimus propter novicios in arte et pauperes intellectus, et nunc ipsum complevimus suo adiutorio cui sit dignus honor, grandis laus cum actionibus gratiarum, concors amor, una fides, rectus timor, et reverens obedientia cum omni supplicatione humilitatis in preceptis eius per nos et sequentes amen, amen." The Munich manuscript ends merely: "Expliciunt iudicia questionum hominum secundum sententiam MICHAELIS SCOTTI grandis astrologi condan imperatoris FREDERICI de terra Teotonica, Deo gratias amen."

I have used the Munich manuscript, cited as Clm., of which I have a complete rotograph, and the Paris manuscript, cited as Nal.

(1) Clm., f. 30; cf. ff. 74, 100, and the *explicit* of the preceding note.

(2) Clm., ff. 38v-43.

(3) E. g., *ib.*, f. 32v.

(4) *Sphæra*, p. 441 ff.; BRUNO A. FUCHS, *Die Ikonographie der sieben Planeten in der Kunst Italiens* (Munich. *Diss.*, 1909), p. 24-29 and plates; SAXL, in *Der Islam*, III, p. 166-168, 175-177, and plate 27; *Catalogus Codicum Astrologorum Graecorum*, V, part I, p. 86. None of these has compared the figures in the Venice manuscript of the so-called NIMROD (Lat. VIII, 22).

logical writers cited are the usual ones : ALBUMASAR, JAFAR, ZAEI, HERMES, DOROTHEUS, THEBIT BEN KORAH, MESSEHALLA, and the *Centiloquium* (1). In one instance the *Liber novem indicum* is specially commended (2). The author also refers guardedly to more dangerous books : a *Liber perditionis anime et corporis* containing the names, abodes, and workings of demons; and a *Liber auguriorum, ymaginum, et prestigiorum* « which we have seen and possessed in our time, although the Roman church prohibits employing them or believing in them (3) ».

Scot has plainly gone beyond the books and conducted his own experiments, leading at times to new results (4). That this experimental temper was shared by his imperial patron we know from FREDERICK's treatise on falconry (5), and Scot gives additional illustrations of this side of the emperor's mind. Not only did FREDERICK, as he himself tells us, have experts brought from Egypt to Apulia to test the incubation of ostrich eggs by the sun's heat (6), but he also experimented with the artificial incubation of hen's eggs (7). Scot advised the emperor to seek counsel at the time of the new moon (8), and to avoid bloodletting when the moon was in

(1) On these and similar authorities see the *Speculum astronomie* ascribed to ALBERTUS MAGNUS (*Opera*, 1891, X. p. 629), and by MANDONNET to ROGER BACON (*Revue néo-scholastique*, XVII, p. 313; cf. PALITZSCH, ROGER BACON'S *Zweite Schrift über die Kritischen Tage*, Leipzig diss. 1918, p. 12-15), with STEINSCHNEIDER's commentary in *Zeitschrift für Mathematik und Physik*, XVI, p. 357-396 (1871).

(2) Clm., f. 128.

(3) Clm., f. 114, 116v.

(4) « Nos quidem fecimus multa nostris temporibus nobis et amicis de quibus vidimus magnam probationem in rebus divinis prout diverse fuerunt instructione libri ymaginum lune. Verbi gratia quadam vice recipiens semper solis radium per bussulum magnum in culo totum perforatum ad instar sachi discussi in ymaginem quam faciebamus ad valimentum cuiusdam rei future et optate diu » Clm., f. 114.

(5) See my article, « The *De arte venandi cum avibus* of the Emperor FREDERICK II », in *English Historical Review*, July, 1921.

(6) *Ib.*, p. 342.

(7) « Et istud fecit probare dominus imperator F. multociens et ita est reperta veritas eorundem. » Clm., f. 117.

(8) « Solebamus dicere domino nostro F. imperatori, Domine imperator, si vultis a sapiente clarum consilium, postulate ipsum crescente luna. » Clm., f. 118.

Gemini, lest the puncture be repeated; but the emperor, wishing to test this for himself, called his barber at this season. The barber assured him there was no danger and staked his head upon it, but after a successful puncture he dropped the lancet accidentally on the emperor's foot, causing a swelling which required the care of a *cynigus* for a fortnight (1). SCOT also gives his version of an experiment which is recounted to much the same effect by SALIMBENE (2). FREDERICK had SCOT calculate the height of the starry heavens — whatever that may mean — by the tower of a certain church, and then had the tower cut off somewhat and casually brought SCOT back to the site. SCOT took his observation and answered that either the heavens were more distant or the tower had sunk a palm's breadth or less into the earth, both of which were impossible, whereupon the emperor embraced him in admiration of his skill (3).

(1) "Eligitur purgatio et diminutio sanguinis et proprie manus luna existente in signo igneo vel aereo, excepto signo Geminorum quod dominatur manibus et brachiis notando quod tunc geminari solet percussio lanceole. Hoc autem voluit videre dominus meus F. imperator et sic quadam vice luna existente in signo Geminorum vocavit suum barberium dicens ei. Est modo tollere sanguinem? Barberius dixit, Sic domine, quia tempus pulcrum est et quietum, vos autem estis bone sanitatis, etc. Cui dixit imperator, Magister, timeo ne bis me percutiatis, quod quando contingit periculosum est, etc. Tunc barberius ait, Domine, volo perdere caput si plusquam semel vos percussero, etc. Tunc dedit sibi verbum et in uno ictu exivit rivulus sanguinis. Letatur barberius dicere imperatori, Domine, timebatis de bina percussione. Habens vero barberius lanceolam in manu apposuit eam sibi in ore, quam cum sic teneret cecidit super pedem imperatoris et imperator fuit in culpa. Illa cum carnem tetigisset exivit sanguis cum dolore et inde secutus est tumor unde locus habuit consilium cynigi 15. diebus. Videns barberius casum et percussam dixit, Domine, grandis sapientia est in vobis et magna provissio futurorum, etc." Clm., f. 114v.

(2) Ed. HOLDER-EGGER, p. 353.

(3) "De hoc probavit nos imperator in venatione apud turrim cuiusdam ecclesie ville. Facta autem ratione per geometriam et arismetricam ei diximus summam miliariorum et hanc fecit notare in scriptis. Interim fecit latenter truncari turrem per .i. semissum, iterum conduxit me in venatione per illas partes et cum fuimus iuxta turrem finxit se non bene recordari de summa numeri mensurationis cacuminis turris usque ad celum sydereum et sic secundo petiit rationem facti a me. Facta vero ratione sapienter nec invenerim ut prius, dixi, Domine, aut celum superius ascendit quam erat externa die vel turris intravit terram per unum palmum sive semissum, quod est mihi impossibile credere, et cum non perpenderem detruncationem pedis turris factam latenter ipse imperator amplexatus est me et miratus est valde de sententia numeri et omnis qui cum eo erat." Clm., f. 31.

Apart from these mentions of the emperor, there are few references to Italy. SCOT tells us he predicted the rising of Aquila in Italy 20 December (1). He begins the year in the Pisan style (2), and notes that the imperial notaries begin the year at Christmas and the Venetian notaries with the Lord's incarnation (3). In the streets of Messina and Tunis (?) there are fortune-tellers who follow the Oriental precepts of ALCHANDRINUS and seek out newly arrived merchants (4). Among the questions which the astrologer must be prepared to answer are those concerning the acceptance of election as *podestà* or the fate of a city in war (5); indeed the whole account of the wealth and position of the astrologer and his mode of life (6) reflect the influence and position of the profession in the Italy of the thirteenth century.

The *Liber particularis* (7), also written at FREDERICK's request, is likewise a popular introduction. Much briefer than the *Liber introductorius*, it seeks to supplement this in certain particulars, as the preface explains :

Incipit liber particularis MICHAELIS SCOTTI astrologi domini FREDERICI Rome imperatoris et semper augusti quem secundo loco breviter compillavit ad eius preces, in nomine JESU CHRISTI qui fecit celum et terram in intellectu, Prohemium.

Cum ars astronomie sit grandis sermonibus philosophorum et quod

(1) Clm., f. 86v.

(2) *Ib.*, f. 60.

(3) *Ib.*, f. 71.

(4) " Et talis modus qualem ALCHADRINUS ostendit in generali servatur inter Arabes et aliquos Indorum, ut patet in viis et stratis Messine et Tonisti in quibus sunt mulieres docte que invitant novos mercatores inquirere de statu illorum, de domo sua, de fortuna suae mercationis, etc. " *Ib.*, f. 119.

(5) *Ib.*, f. 133v, 142v.

(6) *Ib.*, f. 118v.

(7) It is found in the Bodleian, MS. Canon. Misc. 555, ff. 1-59, dated 1256 (unless otherwise stated, references below are to this manuscript); the Ambrosian, MS. L. sup. 92, f. 1-89, where the date 1256 also appears; Bibliothèque Nationale, MS. n. a. lat. 1401, f. 129-162v, incomplete at beginning and end, following *Liber introductorius*; Escorial, MS. e. III. 15, incomplete at the end. Vatican, Rossi MSS (*Neues Archiv*, XXX, p. 353f.); Breslau, MS. f. 21; (PERTZ, *Archiv*, XI, p. 704; QUERFELD, p. 14). The extracts in MS. Corpus 221, f. 2-53 (COXE, *Catalogi*, p. 88) are probably in part from the *Liber particularis*.

de ipsa multi multa scripserunt et diversa veluti cognoverunt semel et pluries experimentis celestium et per celestia de terrestribus, ideoque que compendiose sufficiunt scribere novicio in eadem arte ad preces domini nostri FREDERICI Rome imperatoris et semper augusti iuxta vulgarem in gramatica compillavi ut aliquis novicius hoc opus inveniat quantum per se valeat studere in ipso et de arte astronomie intelligere competenter (1)... Sed quia in precedenti libro tractavimus de hiis que utilia sunt et necessaria omni volentium scire prenominatam artem, in hoc secundo libro adhuc recitamus quedam particularia de arte plenius que vero sunt penitus de necessitate cognoscenda pariter et scienda. Et hec que intendimus dicere in illo non tetigimus quod sciamus. Qui vero hos duos libros plene noverit ac sciverit operari nomen novi astrologi optinebit (2).

The treatise contains relatively little astrology in the narrower sense, being devoted to the reckoning of time, where the author cites HELPERIC, BEDE, GERLAND (?), and modern computists (3); sun, moon, and stars; the winds and tides; and various meteorological questions, many of which are also touched in the *Liber introductorius*. The whole is a curious mixture of ISIDORE, Roman tradition, ARISTOTLE'S *Meteora*, ecclesiastical writers, and bits of Arabic learning. The setting is Italian and in large measure Sicilian, mention being found of the *tramontana* and the oppressive south wind, the Germans in the Romagna and the mark of Ancona (4), the sulphur baths of Montepulciano, Poretta, and Montegrotto (5), and the volcanic phenomena of Sicily.

(1) Here follow a list of writers on astrology, much as in the *Liber introductorius*, and a list of necessary instruments: "tabule Tolletune vel alie meliores eis ac faciliores si unquam appareant, studiosa compotatio algorismi in suis speciebus, horologium perfectum, astrolabium integrum, quadrans iustum, et spera lignea qua utuntur phylosophi ad oculum cum tractatu regularum Parisiensi, cui spera in nostro magisterio addidimus circulos planetarum sperales quos collocavimus seriatim infra zodiacum cum corporibus planetarum designatis."

(2) MS. Canon. Misc. 555, f. 1-1v; MS. Ambrosian, L. sup. 92, f. 1-2.

(3) "Computiste ecclesie, ut ALBERICUS, GIRARDUS, et BEDA", MS. Canon. Misc. 555, f. 6v; computiste moderni, *ib.*, f. 10.

(4) "Idem est de bestiis, verbi gratia gentes Alamanie in asta sunt difficiles gentibus Romaniote ac marchie de Ancona, etc." MS. Canon., f. 41v.

(5) "Ut patet in Pulicano Viterbii, in comitatu Padue ubi dicitur Mons Gotus, etc." MS. Canon., f. 43v; see also below.

The most interesting part of the *Liber particularis* is the last quarter, consisting of a series of questions of **FREDERICK II** on various scientific and quasi-scientific matters, with **MICHAEL SCOT**'s answers. **FREDERICK**'s use of the questionnaire has long been known from the so-called « *Sicilian Questions* » directed to the various Saracen rulers and preserved in part through the answers of **IBN SABIN** of Ceuta analyzed by **AMARI** in 1833 (1). More recently fragments of a set of questions on optics have been recovered by **WIEDEMANN** (2). The series printed below is, so far as I am aware, unknown and doubtless owes its preservation to its incorporation as an addendum to the *Liber particularis* (3).

Cum diutissime **FREDERICUS** imperator Rome et semper augustus oppinatus fuisset per institutum ordinem o semetipso de varietatibus tocius terre que sunt et apparent in ea supra eam inter eam et sub ea, quadam vice me **MICHAELEM SCOTUM** sibi fidelem inter ceteros astrologos domestice advocavit et in occulto fecitque mihi sicut eidem placuit has questiones per ordinem de fundamento terre et de mirabilibus mundi que infra continentur, sic incipiens verba sua :

Magister mi karissime, frequenter ac multipharie audivimus questiones et solutiones ab uno et a pluribus de corporibus superioribus, scilicet solis et lune ac stellarum fixarum celi, et de elementis, de anima mundi, de gentibus paganis et Christianis, ac de ceteris creaturis que sunt communiter super terram et in terra ut de plantis et metallis. Nundum autem audivimus de illis secretis que pertinent ad delectum spiritus cum sapientia, ut de paradiso, purgatorio et inferno ac de fundamento terre et de mirabilibus eius. Quare te deprecamur amore sapientie ac reverentia nostre corone (4) quatenus tu exponas nobis fundamentum terre, videlicet quomodo est constancia eius super habyssum et quomodo stat habyssus sub terra et si est aliud quod sufferat terram quam aer et aqua, vel stet per se an sit super celos qui sunt sub ea; quot sint celi et qui sint sui rectores ac in eis principaliter commorentur; et quantum unum celum per veracem mensuram cesset ab alio, et quod est extra celum ultimum cum sint plures et quanto unum celum est maius alio; in quo celo

(1) « Questions philosophiques adressées aux savants musulmans par l'empereur **FRÉDÉRIC II** », in *Journal Asiatique*, 5^e s., t. I., p. 240-274; 7^e s., t. XIV, p. 341.

(2) « Fragen aus dem Gebiet der Naturwissenschaften gestellt von **FRIEDRICH II** », in *Archiv für Kulturgeschichte*, XI, p. 483-485 (1914).

(3) MS. Canon. Misc. 555, f. 44v; Ambrosian MS. L. sup. 92, f. 69; MS. n. a. lat. 1401, f. 156v, a somewhat different text, briefer at some points but containing the two additional passages printed in the following notes.

(4) Ac imperii maiestatis, the Paris MS. adds.

Deus est substantialiter, scilicet in divina maiestate, et qualiter sedet in trono celi; quomodo est associatus ab angelis et a sanctis, quid angeli et sancti continue faciunt coram Deo. Item dic nobis quot sunt habysse et qui sunt spiritus commorantes in eis nomine, ubi sit infernus, purgatorius, et paradysus celestialis, scilicet an sub terra vel in terra vel supra terram (1). Item dic nobis quanta est mensura huius corporis terre per grossum et per longum, et quantum est a terra usque in celum altissimum et a terra usque in byssum, et si sit una byssus vel sint plures byssi, et si sunt plures quantum cesset una ab alia; et si hec terra habeat loca vacua vel non ita quod sit corpus solidum ut lapis vivus; et quantum est a facie terre deorsum usque ad celum subterius. Item dic nobis quomodo aque maris sunt sic amare ac fiunt salse in multis locis et quedam sunt dulces extra mare cum omnes exeant de vivo mari. Item dic nobis de aquis dulcibus quomodo ipse omni tempore eructuant extra terram, et quandoque de lapidibus et de arboribus ut vitibus velud in vere apparet per putationem, unde veniunt et surgant et quomodo est quod earum quedam eructuant dulces et suaves quedam clare et quedam turbide ac quedam spisse ut gummoze. quoniam mirramur ex eis valde eo quod scimus iundiu quod omnes aque exeunt de mari et euntes per diversa loca regionum et venarum adhuc intrent in mare, et ipsum mare est tantum et tale quod est lectus et receptaculum omnium aquarum decurrentium. Unde vellemus scire si sit unus locus per se qui habeat aquam dulcem tantum sicut unus est que habeat aquam salsam, an sit ambarum aquarum unus locus, et si est unus quomodo iste due aque sunt sibi tanta contrarie cum ratione diversitatis colorum et saporum atque motuum videatur quod sint duo loca. Unde si sint duo loca aquarum scilicet dulces et salse, querimus certificari quis eorum sit maior et minor, et quomodo est quod hee aque decurrentes per orbem terre videantur eructuare omni tempore ex nimia habundancia sui de loco sui lecti, et licet tam copiose habundent illico tamen non multiplicant quasi ultra communem mensuram ratione tanti additus sed sic stant eructuantes quasi ex una mensura vel ad similitudinem unius mensure. Vellemus etiam scire unde fiunt aque salse et amare que per loca reperiuntur surgitorie et aque fetide, ut in multis locis balnearum et piscinarum, an ex se ipsis fiant vel aliunde. Similiter iste aque que per loca eructuant tepide vel bene calide aut ferventes velut essent supra ignem ardentem in aliquo vase quomodo sunt ita, unde veniunt et unde sint et quomodo est quod aquarum eructantium quedam semper fiunt clare quedam turbide. Vellemus etiam scire quomodo est ille ventus qui exit de multis partibus orbis et ignis

(1) Here the Paris MS. inserts: " Et que sit differentia animarum que cotidie illuc deferuntur et spirituum qui de celo ceciderunt, et si una anima in alia vita cognoscit aliam et si aliqua potest transire ad hanc vitam causa loquendi et se demonstrandi alicui, et quot sunt pene inferni. "

qui eructuat de terra tam planure quam montis; similiter et fumus apparens modo hic modo illic unde nutritur et quod est illud quod facit ipsum flare, ut patet in partibus Scicilie et Messine sicut in Moncibello, Vulcano, Lippari, et Strongulo. Quomodo etiam est hoc flamma ignis ardentis visibiliter apparet non solummodo in terra sed in quibusdam partibus maris Indie (1).

Then begins Scor's long reply :

« Cui ego MICHAEL SCOTTUS tanquam scottatus a multis et a diversis libere spopondi dicere veritatem cum vehementi admirratione tantarum et talium questionum : O bone imperator, per memetipsum oppinor vehementer quod si unquam fuisset homo in hoc mundo qui per suam doctrinam evasisset mortem, tu es ille qui inter ceteros debuisses evadere. Sed mors est talis calix et tam communis quod ex eo bibit et bibet omnis sapiens et insipiens, cum in hoc mundo nihil reperiatur fortius morte. Tamen doctrina sapientum vivorum et mortuorum que in hoc seculo dicitur vel scripta reperitur ad instruendum indoctos et ad memorandum peritos donec vita permanet proficit multis et in multis, videlicet quantum ad corpus et quantum ad animam, de qua multum curandum est. Et ideo mihi est valde acceptabile duras questiones audire eo quod tunc proficio in scientia multis modis principaliter dum sunt ipsius scientie qua potior et glorior inter gentes ac me penes vos video honoratum. Unde sicut constituitis cor vestrum ad has cogitationes questionum quas nunc mihi dilucidastis ordine pretaxato, sic ponite aures vestri capitis ad audiendum et mentem vestram ad intelligendum plenam satisfactionem omnium predictorum que vobis leviter et sine disputatione pandere non pigritabor si Deus voluerit. »

This boastful preface introduces thirty pages of manuscript which it is unnecessary to reproduce in full. Brief statements concerning hell, purgatory, heaven, and the terrestrial paradise are followed by an account of the marvels of nature — strange lakes and rivers of the East, wondrous metals, stones, plants, drugs, and animals, with their respective virtues. The magnet is mentioned incidentally three times (2), each time as something well known. The most interesting

(1) The Paris MS. adds . « Et quomodo est hoc quod anima alicuius hominis viventis dum transierit ad aliam vitam quod nec amor primus nec etiam odium dat sibi causam redeundi tanquam nihil fuisset, nec de remanenti re videtur amplius curare sive sit salvata sive dampnata. »

(2) « Per calamitam scitur ubi est tramontana cum acu, et cognito domino anni adequatione tabularum de Tolleto scimus quod futurum est in rebus. » MS. Canon. Misc., f. 48v. « Item est lapis qui sua virtute trahit ferrum ad se ut

of these chapters is that on metals, a summary of alchemistic doctrine which can be usefully compared with the alchemical writings attributed to Scot :

Metallum est quedam essentia que dicitur secunde compositionis, cuius species sunt 7, scilicet ferrum, plumbum, stagnum, ramum, cuprum, argentum, et aurum, sciendo quod generantur compositione argenti vivi, sulphuris, et terre. Et secundum unitam materiam eorum quibus componuntur sunt ponderis et coloris. Aurum plus tenet sulphuris quam argenti vivi; argentum tenet plus argenti vivi quam terre et sulphuris; ferrum plus tenet terre quam argenti vivi, etc. Valet quodlibet ad multa ut in compositione sophystica et in aliis virtutibus. Verbi gratia : aurum macinatum valet senibus volentibus vivere sanius et iuniores esse sumptum in cibo, et per eum comparantur multi denarii argenti causa expendendi, fiunt multa monilia, decorantur vasa, et pro eo acquiruntur femine ac multe possessiones. Argentum emit aurum et ex eo multa acquiruntur ut ex auro et fiunt ut denarii, vasa, etc. Stagnum valet ad faciendum vasa et aptandum ferrum laboratum et ramum. Idem dicitur de plumbo ramo etc. Sophysticantur metalla doctrina artis alchimie cum quibusdam additamentis pulverum mediantibus spiritibus quorum species sunt 4, scilicet argentum vivum, sulphur, auripigmentum, et sal ammoniacum. Ex auro cum quibusdam aliis fit plus aurum in apparentia, ex argento et ramo dealbato cum medicina fit plus argentum in apparentia, etc. De argento leviter [fit] azurum. De plumbo leviter fit cerusa. De ramo leviter fit color viridis cum aceto forti et melle. De plumbo et ramo etc. fit aliud metallum. De stagno et ramo fit poltrum cum medicina. Argentum vivum destruit omne metallum ut patet in moneta quam tangit et stagno enius virgam rumpit tangendo, etc. De plumbo fiunt manubria lime surde quo sonus mortificatur. Argentum vivum interficit edentem et tollit auditum si cadat in aures. Metallorum aqua, ut ferri arsenici vitrioli calcis et virideramini, corodit et frangit calibem. Ex vilibus et muracido ferro fit ferrum andanicum, et ecce mirrabile magnum (1).

Coming at last to the emperor's penetrating questions concerning the earth, Scot explains that the earth is round like a ball, surrounded with water as the yolk is surrounded in the egg, the waters being held in their place by a secret virtue; but any further

calamita et ostendit locum tramontane septentrionalis. Et est alius lapis generis calamite qui depellit ferrum a se et demonstrat partem tramontane austri. » *Ib.*, f. 50. « Calamita reconciliat uxorem ad maritum. » *Ib.*, f. 50v. Cf. *Physiognomia*, part 1, c. i. On the compass in the XIIIth century see the various studies of Schüek (*Isis*, IV, 438) and of GÜNTHER in *Deutsche Revue*, March, 1914.

(1) MS. Canon., f. 5, MS. Ambrosian, f. 76v.

knowledge of this is beyond human ken and merit. The distance to the extreme of the waters beneath the earth equals the distance to the moon. After air ends fire begins, extending from the moon to the eighth sphere, then a multitude of waters and then the ether as far as the ninth sphere, the spheres being fitted one about another like the layers of an onion. The waters of the sea are bitter because they are older and are not exposed to the sun's heat. Waters were created with inexhaustible virtue of pouring forth so long as the world endures, and they move about in the earth like blood in the veins, the quality of the water depending on the earth through which it passes, and its heat coming from dry, hot rocks, especially sulphur. The hot springs of Montegrotto, Porretta, and Montepulciano and the volcanic outpourings of Etna and the Lipari islands are explained as follows (1):

Nam illius quod me interrogastis de flammis ignis que visibiliter apparent in multis locis huius mundi ut in partibus Scicilie etc., iam supra diximus intellectum huius in capitulo quod incipit, Tellus Scicilie, etc., et in capitulo alio quod incipit. Queri solet de aquis fluminum (2). Sed quia de hoc facta est expressa questio iterum studebimus dictas questiones solve. Unde dicimus quod in ventre terre sunt saxa sulphuris vivi et petre calidissime nature et in eisdem partibus sunt multe vacuitates quas venas appellamus et fistulas. Causa est fervor caloris quo terra grustificatur cessans a sede illius sulphuris, et ventus qui spirat per orbem reperit fixuras terre in extremis partibus et cavernas qui dum intrat in eas non revertitur retrorsum ymo flat antrorsum de vena in venam et de fistula in fistulam et sic tentans loca cavernosa pervenit ad has vacuitates ubi est tanta copia sulphuris et petrarum calidissimarum, et quia ventus est substantia calida et sicca atque subtilissima et se fricat per tales partes magis subtiliatur, et quia est de materia elementalī recipit compositionem qua cum exit de locis apertis usque que (3) continuator illa multitudo sulphuris et petrarum calidissimarum apparet flammabilis vehementer, et a diversis gentibus iudicatur et creditur esse ignis cum habeat omnes condicione signis nostri, scilicet motu sintilis figura dumi fumo et cinere in eisdem partibus. Calore vero tali aer in eisdem partibus inflammatur et fit subtilis calidus et sulphure odoriferus. Unde aque calide et bullientes surgunt

(1) MS. Canon., f. 56v-57v; MS. Ambrosian, f. 85-86v; not in Nal.

(2) MS. Canon. Misc. 555, f. 40, 43, where these topics are more briefly discussed.

(3) *I. e. usquequaque.*

in eisdem partibus et sunt balnee multe, sicut est Pellicanus apud Viterbium, balneum de Porreta, de Monte Gotto in districtu Padue, etc., sciendo quod ubi habundat calor et sulphur sub terra crescit aurum et nascitur, econtraria parte nascitur plumbum ferrum et argentum utrumque. Sunt etiam aque frigide, lacus magni, nives, etc., unde substantia illius flammæ ignis parissibilis in certis locis terre et maris non est aliud quam vapor calidus et siccus violenter inflammatus a maiori calore et siccitate, quod totum fit secundum quod prediximus. Et quia ventus non cessat antecedere sive per aerem expeditum ut supra terram sive per cavernas terre prepeditem, aut in exitu loci exit calidus invisibiliter aut inflammabilis visibiliter aut frigidus invisibiliter. Et est sciendum quod si sulphur continuatur producte usque ad exitum venti exit ventus in modum flammæ quæ est magna vel parva secundum quantitatem substantiæ venti et habundanciam caloris et conditionem aeris quem reperit impeditum ab aliqua impressione vel absolutum, et hoc dico tam de vento invisibili quam visibili et tam de frigido ut in partibus Sclavonie et Alamannie quam in partibus Scicilie, etc. Ut etiam patet per Strongulum montem qui est in medio maris et per Strongulinum, per Vulcanum et Vulcaninum, per Moncibellum et per insulam Lipari in qua sunt omnia genera bonarum arborum et herbarum. Nam Strongulus est mons magnus in mari et de summate illius exit continue magna flamma ignis. Similiter exit continue flamma ignis de summate montis Strongulini qui est mons minor Strongulo. De Monte Vulcani et Vulcanini, Moncibelli et insule Lipari dicimus quod ex eis quandoque exit flamma ignis ut quociens ventus qui dicitur auster spirat et non alias et quando cessat flamma exit fumus maximus. Et est sciendum quod ista flamma ignis cuiuslibet dictorum locorum sepe importat lapides adustus et quandoque sticiones lignorum et cinerum quæ cooperit totam terram inde et aerem sepe obcecat ut est in partibus fluminum de arena. Eiciuntur etiam multi igniculi extra in altum cum flamma ardentiores ut ferrum focine fabri sintillans qui descendendo franguntur in multa frustra et magna et parva, et hec reperiuntur esse pomices quibus utuntur scriptores, et has pomices mare portat ad littora et colliguntur a gentibus et inde murantur domus et parificantur ut apud nos de lateribus, quare in eisdem partibus sunt montes et fragmenta ut de lapidibus apud ceteras regiones. Aqua quidem pellagi est inde frigens et sulphurea unde marinarii transeuntes hinc quandoque implent nodos harundinum et catinos de illa aqua quæ cum est frigida esse sulphur probatur coagulatione, et est sciendum quod quanto plus aqua accedit prope montes ubi bullit tanto magis sulphur est melior. Verum est quod sulphuris alius albus alius niger alius zallus, etc., sciendo quod unusquisque habet certas virtutes magni valoris, ut in alchimia ad commutandum metalla et ad faciendum focum zambanum, unguenta ad scabiem, etc., suffumigatio cuius dealbat setam zallam et folia rose et lili et cum ardet reddit

aerem feculentum. Insuper dicimus quod sit illa flamma esset ignis ut noster exstingueretur ab aqua que est nostro igni contraria percurrens sub terra in partibus sulphureis in quibus inflammatur, sciendo quod sicut est cursus aquarum super terram et origo fontium lectus fluminum et multitudo lacuum et stagnorum, sic est inter terram. Item dicimus quodsi diete petre tam calide nature essent super terram sicut sunt in ea absconse et sulphur cum eis, iam mundus esset undique consumatus caliditate flatus ventorum inde transeuntium. Sed cum misericordia Dei sit maxima in dispositione constitutionis mundi, hunc sulphurem et hos lapides locavit inter terram propter melius, nolens quod mundus taliter destrueretur, unde voluntate Dei flamme dictorum locorum nec mundum destruunt nec loca sibi propinqua, unde super dictos montes sunt domus que ab hominibus inhabitantur et cultus terre quo fructus habentur multi.

Such evil signs have led many to believe that these volcanoes are the entrance to the hell which is vividly described in the vision of St. PAUL in prison; but whether the gate to the lower regions is here or in the northern isle seen by St. BRANDAN, SCOT will not decide. Whatever the way in, hell is in the bowels of the earth, and there is no way out (1).

SCOT does not answer all the emperor's questions and his answers are far from satisfactory, yet all is not empty words. He has some acquaintance with the principal sulphur springs and volcanoes of Italy, and, while his knowledge of the Lipari group does not necessarily rest on personal observation, it at least represents inquiry among those who have observed. Although the omission of any special account of Etna is noteworthy, he has in these local matters gone well beyond ARISTOTLE'S *Meteorology* and given some real description of volcanic phenomena. Nevertheless, making all allowance for the fact that it is easier to ask questions than to answer them satisfactorily, the emperor's questions show the keener mind

(1) The treatise ends : " Hec autem que breviter et facile diximus nunc ut melius fuit nobis visum, vobis, domine imperator, sufficiant ad presens de recitatione mirrabiliū mundi que Deus fecit cum magno delectu ad instar ioculatoris et adhuc facit continue, et de expositione fundamenti terre. Volentes hic finire secundum librum quem incepimus in nomine Dei cui ex parte nostra sit semper grandis laus et gloriosa benedictio et triumphus in omnibus per infinita secula seculorum amen. Explicit secundus liber MICHAELIS SCOTTI qui dicitur liber particularis. Nunc incipit liber physionomie "... MS. Canon. Misc. 555, f. 59; Ambrosian MS. L. sup. 92, f. 88v-89.

and the more penetrating intelligence. They raise real difficulties, and, like those preserved by IBN SABIN, they cut deeply into the current cosmology. That one who can go so far in these directions should at the same time accept implicitly the facile predictions of the court astrologers, is one of the typical contradictions in the intellectual life of the xinth century.

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L'Enseignement de la Mécanique en France au XVII^e siècle

La science avance-t-elle par une série de sauts brusques, correspondant à des découvertes et dus à des hommes déterminés, ou est-elle au contraire le résultat d'une évolution insensible, le fruit d'un effort collectif et en grande partie anonyme? Cette vieille question a été récemment remise à l'ordre du jour, en ce qui concerne la mécanique, par les savants travaux de PIERRE DUHEM. On sait qu'à la suite d'une étude approfondie de l'histoire de la science, DUHEM a formulé des conclusions qui bouleversent l'opinion commune relative aux origines de la mécanique moderne. Celle-ci ne serait pas née brusquement, comme on le croit, au cours du XVII^e siècle. Elle n'aurait pas pour père GALILÉE. Mais elle serait l'aboutissement direct de la pensée du moyen âge qui, à travers de multiples péripéties, aurait lentement mûri au sein des vieilles universités. C'est le fil de cette pensée qu'auraient ensuite repris KEPLER, GALILÉE et DESCARTES. Toutefois leurs contemporains — qui, pour la plupart, ignoraient tout du passé et le méprisaient — ne s'en sont point aperçus. Trompés à leur tour, les historiens modernes crurent de bonne foi qu'une science nouvelle avait été créée par cette poignée d'hommes éminents dont les noms étaient universellement célébrés. Ils méconnurent les philosophes qui avaient précédé KEPLER et GALILÉE; ils ignorèrent les savants plus modestes qui, au XVII^e siècle même, collaborèrent dans l'ombre à l'œuvre collective. De là, sur l'évolution de la mécanique, une vue complètement erronée, que DUHEM cherche à corriger en rétablissant la chaîne continue dont on n'apercevait, avant lui, que quelques anneaux.

Il y aurait beaucoup à dire sur ces conclusions. Je me contenterai aujourd'hui d'insister sur une distinction qui a été déjà bien souvent signalée, mais que DUHEM paraît avoir un peu perdue de vue.

Lorsqu'on étudie l'histoire des problèmes mécaniques et physiques, on doit avoir soin de séparer, d'une part les théories où se reflète l'enseignement donné ou reçu par les savants dont on analyse les œuvres, d'autre part les idées originales qui se sont dégagées de ces œuvres et qui ont exercé une action positive sur le cours de la science. — Les idées directrices qui sont à la base de la mécanique moderne sont relativement simples et peu nombreuses; elles sont précises ou elles ne sont pas, et elles ne comportent pas de degrés; aussi, à qui considérera uniquement les idées et les principes, le développement de la mécanique apparaîtra presque certainement comme discontinu. Au contraire, les conditions dans lesquelles se donne l'enseignement lui confèrent nécessairement — fût-ce d'une manière artificielle — un caractère de continuité. Le professeur d'université, ou l'auteur de manuel, a tendance à toujours répéter les mêmes leçons; lorsque les progrès de la science l'obligent à remanier son cours, il conserve le plus possible des théories anciennes et y insère adroitement les idées ou les faits nouveaux en rendant la soudure aussi peu apparente que possible. Ce travail de mise au point est souvent fait si ingénieusement qu'il devient presque insensible. Aussi l'historien qui jugerait de l'évolution de la science d'après les livres d'enseignement verrait-il celle-ci se dérouler comme une chaîne parfaitement unie, ainsi que le dit PIERRE DUHEM.

Mais, précisément DUHEM ne fonde-t-il pas principalement ses conclusions sur l'étude d'ouvrages qui sont des manuels d'enseignement, des cours de professeurs? Les traités du moyen âge et du *xvi^e* siècle qu'il a analysés rentrent presque tous dans cette catégorie. Les écrits de jeunesse de GALILÉE — qui n'ont d'ailleurs pas été publiés de son vivant et auxquels on attache peut-être aujourd'hui trop d'importance — sont le résumé de ses leçons. Les premiers écrits du Père MERSENNE sur la mécanique, les traités d'HERIGONE, du Père FABRI ou du Père DECHALES, auxquels DUHEM accorde une place importante dans ses *Origines de la statique*, sont des ouvrages purement scolaires. N'est-ce pas parce qu'il s'est longuement attaché à de tels auteurs que DUHEM a été conduit à sa doctrine historique?

Nous serons portés à le croire si, en appliquant nous-mêmes la méthode de DUHEM, nous cherchons à poursuivre son œuvre. DUHEM n'a pas eu le temps d'étudier le *xvii^e* siècle aussi complètement qu'il a étudié le moyen âge. Il a laissé de côté pas mal d'ouvrages qui ne sont guère connus des historiens. Or, si nous recherchons et parcourons

ces ouvrages, nous nous trouvons tout d'abord naturellement entraînés à raisonner comme DUHEM. Non seulement nous rencontrons à chaque pas de nouveaux indices de l'évolution continue dont il nous parle, mais nous voyons les chaînons, les intermédiaires se multiplier de plus en plus. Si nombreux sont les arguments analogues à ceux de DUHEM que nous fournit la période du ^{xvii}^{me} siècle que des doutes finissent par naître dans notre esprit. Les raisonnements qui prouvent trop sont suspects à juste titre, car ce sont bien souvent ceux-là qui ne prouvent rien. Et, de fait, une question préalable domine le problème. Parmi tous ces écrits, où les théories scientifiques paraissent s'ébaucher, puis se développer, et se transformer progressivement, quels sont ceux qui ont eu effectivement quelque influence? L'histoire de la pensée scientifique du moyen âge et de la Renaissance nous est trop mal connue pour que nous puissions dire jusqu'à quel point tels ou tels intermédiaires ont été nécessaires, dans quelle mesure telles formes transitoires des théories ont contribué à préparer leur épanouissement final; il est également difficile de savoir quelles connaissances un GALILÉE ou un DESCARTES a directement ou indirectement puisées de l'œuvre du moyen âge (DUHEM n'hésite pas à croire que ces savants ont lu beaucoup plus d'auteurs anciens qu'il n'apparaît d'après leurs citations). Mais, par contre, nous sommes renseignés en détail, par de nombreuses correspondances, sur les relations qu'ont eues entre eux les savants du ^{xvii}^{me} siècle. Nous pouvons ainsi contrôler l'impression que nous donne, à première lecture, la série des ouvrages secondaires auxquels je faisais allusion tout à l'heure. Or, si nous procédons à ce contrôle, notre premier sentiment, favorable à la thèse de DUHEM, ne tarde pas à disparaître.

Grâce à l'abondance des documents dont nous disposons pour l'étude du ^{xvii}^{me} siècle, nous nous formons une conviction qui équivaut presque à une certitude : les ouvrages d'enseignement, pendant cette période, n'ont joué à peu près aucun rôle dans la formation de la science moderne. Faits de pièces et de morceaux et présentant sous un jour trompeur l'enchaînement historique des théories, ils ne nous éclairent que peu ou point sur la marche véritable de la pensée créatrice. S'ensuit-il, cependant, que l'historien doive négliger les ouvrages de ce genre? Non, car nombre d'entre eux nous fourniront des indications précieuses sur les circonstances au milieu desquelles la pensée scientifique s'est développée, sur les traditions et les habitudes d'esprit contre lesquelles elle a dû réagir. Ils ne nous

instruisent pas du progrès de la science, mais plutôt ils nous feront connaître les obstacles et les résistances qui ont contrarié ce progrès. C'est là un point de grande importance, et c'est pourquoi l'on doit, à mon avis, étudier attentivement, à la suite de DUHEM, l'histoire de l'enseignement scientifique, tout en la distinguant soigneusement de l'histoire de la science proprement dite.

On trouvera ci-dessous, à l'appui des remarques et des réflexions que je viens d'énoncer par avance, quelques exemples tirés de l'enseignement de la mécanique en France au ^{xvii}^e siècle et, plus particulièrement, après 1650.

* * *

Dans les ouvrages antérieurs au ^{xvii}^e siècle le mot même de « mécanique » était le plus souvent employé dans un sens assez restreint (1). Il ne s'appliquait qu'à la théorie des machines simples, étudiée par les méthodes statiques d'ARCHIMÈDE et des Alexandrins ou par les méthodes exposées dans le traité aristotélicien (2) des

(1) Cette acception s'est d'ailleurs conservée pendant tout le ^{xvii}^e siècle, et nous la retrouvons encore, par exemple, dans le *Dictionnaire mathématique* d'OZANAM (1691). C'est dans cette même acception que DESCARTES prend le mot *mécanique* lorsqu'il compose, à la demande de CONSTANTIN HUYGENS, un petit traité de statique, qu'il appellera « Mes Mécaniques ». MONANTHEUIL définit la mécanique, en termes plus généraux, mais équivalents : « l'art de fabriquer des machines pour tirer, pousser ou porter les corps qui surpassent les forces humaines » ou encore « l'art de forcer les corps autant qu'il est possible à aller contre leur nature ». Un cours que nous citerons plus loin (LE MONNIER, vers 1700) définit semblablement la mécanique « la science qui enseigne par quels moyens les corps difficiles à mouvoir peuvent être mus plus facilement ». La définition d'HERIGONE (*Cours mathématique*, 1634) est plus moderne. Elle se distingue des précédentes en ce qu'elle fait intervenir la notion de *temps* et par conséquent celle de mouvement effectif (et non plus seulement les cas d'équilibre ou de rupture d'équilibre). « La mécanique — dit HERIGONE — est la science qui considère les forces mouvantes et la durée du temps du mouvement ». L'*Abbrégé de Méchanique* de SAUVEUR, que nous citerons à la fin de cet article, part d'une définition analogue : « La mécanique est une science qui examine la propriété des mouvements. Dans les mouvements il faut considérer la masse, la vitesse, la direction ou la détermination du corps et la quantité de mouvement ». MERSENNE donne de la mécanique une définition beaucoup plus générale et fantaisiste : la mécanique est un art qui sert, tantôt à imiter la nature comme fait le peintre, tantôt à l'aider comme fait le médecin, tantôt à la contraindre ou à la tromper comme dans les cas des machines, etc.

(2) On sait qu'il n'est pas certain que ce traité soit l'œuvre d'ARISTOTELE lui-même.

Questions mécaniques. A côté de cette théorie restreinte, cependant, une autre — plus vaste — était enseignée dans les cours de physique : une théorie générale des mouvements, fondée principalement sur la *Physique* et le *Traité du Ciel* d'ARISTOTE et sur les commentaires relatifs à ces traités. Les cours de physique, qui rattachaient les phénomènes de mouvement à l'ensemble des propriétés du monde, avaient un caractère systématique, logique et dogmatique, tandis que les ouvrages inspirés des *Questions mécaniques* tendaient à revêtir une forme mathématique et s'orientaient vers la pratique.

Ainsi se sont constitués peu à peu plusieurs types distincts d'écrits mécaniques que nous trouvons représentés en France au début du XVII^{me} siècle par des échantillons variés.

On publie encore à cette époque de nombreux commentaires des traités physiques d'ARISTOTE. Citons comme exemples ceux de RUPIO, ceux d'EUSTACHE DE SAINT-PAUL, ceux du Collège de Coïmbre, qui eurent de très nombreuses éditions en plusieurs pays, et qui furent indiqués à DESCARTES par le Père MERSENNE (1). D'autre part, MONANTHEUIL, professeur au Collège de France, publie en 1600 un commentaire (2) des *Questions mécaniques*. Et nous possédons par ailleurs plusieurs traités de statique mathématique du même temps qui s'inspirent principalement des écrits des savants italiens du XVI^{me} siècle, GUIDO UBALDO, BENEDETTI, TARTAGLIA et CARDAN, COMMANDIN et MAUROLICO.

Ces divers ouvrages ressemblent entièrement à ceux qui ont été composés par les générations précédentes. Toutefois on y relève certains caractères qui, s'ils ne sont pas nouveaux, paraissent du moins se préciser et s'accentuer.

En premier lieu, les cours de statique, qui doivent beaucoup, comme je viens de le dire, aux auteurs italiens, se séparent de plus en plus des théories physiques et métaphysiques pour devenir purement mathématiques. Ils savent quelquefois être concis et atteignent un haut degré de précision, se rapprochant par l'esprit et par la méthode de nos livres modernes de statique élémentaire. Comme exemple de traité de ce type, on peut, avec le cours de ROBERVAL (3), citer un traité de mécanique dont deux rédactions

(1) *Œuv. de DESCARTES*, éd. ADAM-TANNERY, t. III, p. 185 et notes *ibid.*, p. 194-197.

(2) ARISTOTELIS *Mechanica*, Paris, 1599.

(3) Voir notamment, sur ce traité, les *Origines de la statique* de DUHEM, t. II, chap. XVII.

d'élèves sont conservées à la Bibliothèque Nationale (1). Le cours d'HERIGONE appartient à la même catégorie, et pareillement celui de MERSENNE (*Mechanicorum* (2) *libri*), dont la matière est riche, mais qui est touffu et mal ordonné. Tous ces traités contiennent — avec la théorie classique des machines simples complétée par diverses additions — une théorie générale des centres de gravité et une théorie de l'équilibre sur le plan incliné.

Dans l'enseignement de la physique, d'autre part (et des lois du mouvement en particulier), nous observons un affaiblissement de plus en plus marqué de la structure logique des théories et de leur caractère systématique. Chaque jour la doctrine perd quelque chose de sa pureté et de sa cohérence. Les vieilles idées d'*éléments*, de *lieu* et de *mouvement naturels*, restent la base des explications données; mais elles ne sont plus définies avec précision, leurs propriétés ne sont pas déduites rigoureusement, et l'on néglige de s'assurer si elles ne donnent pas lieu à des contradictions. Combien le monde savant était devenu indifférent à la pureté logique et philosophique de la doctrine, nous en avons la preuve dans le goût qui se manifeste alors pour les traités de physique simplifiés et abrégés. ABRA DE RACONIS condense la physique en quelques pages dans un minuscule manuel (3) qui a eu de nombreuses éditions et que MERSENNE recommande à DESCARTES (4). Le médecin parisien J.-C. FREY (5) fait imprimer en 1633 un *Compendium* analogue. Les traités sommaires et superficiels, mais faciles à lire, de SAINT JEAN DAMASCÈNE (6) et du philosophe byzantin NICÉPHORE BLEMIDAS sont traduits en latin et paraissent appréciés.

(1) Manuscrits, fonds français, 14748 et 14749. La deuxième rédaction est datée de 1708 et contient une allusion à DESCARTES qui ne se trouve pas dans la première. La plus grande partie de ce cours doit remonter au milieu du XVII^e siècle; l'auteur ne connaît ni la théorie du baromètre ni, semble-t-il, aucun auteur postérieur à STEVIN.

(2) Cet ouvrage, publié en 1626, dans l'une des éditions de la *Synopsis mathematica* est un livre d'enseignement qui ne contient probablement que peu de parties originales.

(3) Ce manuel parut successivement sous divers titres : *Totius philosophiæ compendia* (1622), *Totius philosophiæ brevis tractatio* et *Universæ Philosophiæ compendium*.

(4) *Œuv. de DESCARTES*, t. III, p. 194.

(5) *Universæ Philosophiæ compendium luculentissimum*, Paris, 1633.

(6) JEAN DAMASCÈNE est traduit par DE BILLY (1603), NICÉPHORE BLEMIDAS par WEGELIN (1605). Cf. les Préfaces des traducteurs.

En même temps qu'ils perdent leur pureté logique — et à cause de cela même — les traités de physique deviennent volontiers éclectiques. Nous y voyons se côtoyer des explications difficilement conciliables. On se complait à énumérer, sur chaque sujet, les diverses théories proposées sans se prononcer nettement pour l'une ou pour l'autre.

Nous noterons enfin qu'à l'instar des savants du xvi^me siècle, maints auteurs s'évertuent à associer étroitement la théorie et l'application pratique de la science. C'est le cas pour MONANTHEUIL, membre de ce Collège de France qui, depuis ORONCE FINÉ, s'efforce d'introduire la science pratique dans l'enseignement universitaire. Prenant pour texte de ses leçons (1) les *Questions Mécaniques*, MONANTHEUIL y intercale une foule de questions d'actualité, relatives à l'érection de l'obélisque de Rome, à la construction du Pont-Neuf, aux horloges, à l'art typographique, aux mouvements des portefaix parisiens lorsqu'ils soulèvent de grands poids, au mouvement du clou fiché sur une roue (problème de la roulette étudié au xvi^me siècle par le Parisien CHARLES BOUELLES). Ce goût de l'application concrète s'affaiblit au cours du xvii^me siècle (on le trouve encore chez MERSENNE, un peu chez ROBERVAL, et surtout chez des auteurs moins connus comme HENRION ou JEAN BOULENGER). Mais, vers la fin du xvi^me siècle, il contribua fort à faire passer la mécanique au premier rang des études scientifiques. En déclarant que Dieu est géomètre, PLATON — dit MONANTHEUIL (2) — n'a énoncé qu'une partie de la vérité. Dieu est avant tout mécanicien; car, qu'est le monde, sinon une immense machine dont Dieu est le mécanicien. Et c'est pourquoi — ajoute MONANTHEUIL — il n'est pas indigne d'un professeur royal au Collège de France de traiter de la mécanique dans son cours bien que celle-ci ait un caractère d'utilité pratique.

Tels étaient, vers le commencement du xvii^me siècle, les caractères des écrits mécaniques les plus répandus. Comment, au cours des années qui suivirent, les ouvrages de ces divers genres se sont-ils transformés? C'est là ce que nous désirons savoir. Or, lorsque nous regardons avec attention tous les traités que nous connaissons, lorsque nous les comparons entre eux, nous sommes conduits à la constatation que j'énonçais plus haut. Il est impossible de découvrir, dans cette suite d'écrits, l'évolution d'une théorie qui se perfectionne, le progrès

(1) Dans l'ouvrage cité plus haut.

(2) *Loc. cit.*, Préface.

d'une pensée qui mûrit. On y voit seulement une série de retouches assez gauches, opérées par insertion de pièces nouvelles plus ou moins bien rattachées, par retranchement d'autres morceaux, par adaptation à des usages nouveaux de certaines notions artificiellement détournées de leur signification primitive.

Voyons, cependant, de plus près sur quelques exemples, comment s'effectue dans la pratique cet ingénieux travail de rapiéçage.

Le remplacement d'une théorie ou d'une hypothèse scientifique par une autre se fait presque toujours de la même manière. Conformément à la tendance éclectique que je signalais tout à l'heure, on commence par indiquer — comme si l'on voulait simplement documenter le lecteur — les diverses explications des mêmes faits proposées par différents auteurs : on continue toutefois à donner la préférence à la théorie consacrée par l'usage. Puis un nouveau pas est franchi : on déclare qu'il est impossible de se prononcer entre les théories en présence et que le problème considéré est litigieux. C'est ainsi que, dans les examens de doctorat, par exemple, un certain nombre de thèses sont présentées comme incertaines (1) : « Incertum est an...an, ..., etc. ». Enfin, peu à peu, on laisse tomber les hypothèses surannées pour ne conserver que les nouvelles.

C'est de cette manière — il est facile de s'en convaincre — que l'hypothèse de COPERNIC (2) s'est peu à peu introduite dans l'enseignement de l'astronomie. Les traités commencent par présenter côte à côte la série des systèmes proposés depuis l'antiquité : système des sphères homocentriques, système de PTOLÉMÉE, système dit « des Egyptiens » /ou système d'HÉRACLIDE DU PONT, dans lequel les

(1) Cf. les thèses mathématiques soutenues par PONTCHARTRAIN au Collège Louis-le-Grand en 1685, et diverses thèses, soutenues entre 1675 et 1695, figurant dans le recueil coté SX d. 11, à la Bibliothèque de la Sorbonne. On retrouve la même forme d'exposition dans de nombreux ouvrages, — par exemple dans le *Cursus mathematicus* de MILLIET DECHALES (voir t. I, 1674, p. 432) ou dans les *Questions inouïes* de MERSENNE, p. 67 (« On ne sait pas, etc. »)

(2) Cf. notamment, au xvi^e siècle, la *Sphère du Monde* de FINÉ, et, au xvii^e siècle, le *Traité de la Sphère du Monde* de J. BOULENGER, professeur au Collège de France (quatre éditions au moins, la deuxième en 1628), la *Cosmographie* d'HENRION (1^{re} édit., 1620), la *Nouvelle théorie des planètes* de N. DURRET (1635), le *Traité de la sphère de PTOLÉMÉE et de COPERNIC* de l'Écossais J. HUME (Paris, 1637), le traité de FOREST DUCHESNE et le cours de LE MONNIER cité plus bas, etc., traités dont il faut rapprocher les ouvrages de MERSENNE et l'*Institutio astronomica* de GASSENDI.

planètes inférieures tournent autour du soleil), système d'ARISTARQUE « et de COPERNIC », système de TYCHO-BRAHÉ. Puis on refuse de choisir entre ces systèmes. Enfin on laisse entendre que l'hypothèse de COPERNIC est la plus vraisemblable et la plus satisfaisante pour l'esprit; et, si néanmoins l'on rejette cette hypothèse, dit un auteur de thèses (1) en 1685, c'est uniquement parce qu'elle est contraire à l'Écriture. Faisons abstraction de cette dernière restriction, due à la circonstance qu'on est ici en présence d'une condamnation formelle de l'Église : il reste un procédé général de transformation, dont nous rencontrons de fréquentes applications lorsque nous étudions l'histoire des théories de la mécanique.

Je ne m'arrêterai pas aux théories relevant de la statique mathématique. Ici, en effet, on marchait sur un terrain sûr. Une vérité mathématique bien établie est définitive. Aussi, en statique, n'a-t-on guère qu'à ajouter et rarement à retrancher. Il y avait cependant dans la statique du début du XVII^{me} siècle certaines taches qu'il fallait faire disparaître, notamment une théorie très défectueuse du centre de gravité (2) (que l'on voulait définir physiquement, comme le point d'un corps qui tend à s'unir au centre du monde, au lieu d'y voir simplement le centre mathématique d'un ensemble de forces parallèles) et certaines applications vicieuses du principe des vitesses virtuelles et du principe des moments. Mais ROBERVAL a su corriger ces défauts sans toucher au reste de l'édifice, et celui-ci s'est trouvé tout prêt à recevoir les additions dues aux recherches personnelles du savant professeur : sa définition précise de la *force*, et surtout la démonstration générale de la règle de la *composition des forces*. D'autres progrès, comme l'introduction du principe de TORRICELLI sur la descente du centre de gravité, furent également réalisés sans effort.

Plus difficile à effectuer était la mise au point des théories relatives au mouvement, le passage de la dynamique du moyen âge à celle de DESCARTES et de HUYGENS (3). La transformation s'accomplit cependant sans heurt, suivant les principes que nous indiquions tout à l'heure.

L'une des principales questions que l'on avait à étudier était celle de la chute accélérée des graves. DUHEM a montré (4) que les physiciens

(1) PONTCHARTRAIN (voir plus haut).

(2) Cf. DUHEM, *Les origines de la statique*, t. II, chap. XV e XVI.

(3) La mécanique de NEWTON et celle de LEIBNIZ n'ont point le temps de pénétrer dans l'enseignement des écoles françaises avant le XVIII^e siècle.

(4) *Études sur LÉONARD DE VINCI*, 3^e série, 1913 *passim*.

parisiens du ^{xiv}^e siècle étaient arrivés à formuler certaines hypothèses qui — lorsqu'on les rapproche les unes des autres — donnent immédiatement la loi de GALILÉE. Ces hypothèses, cependant, n'étant étayées, ni par des expériences précises, ni par des raisonnements solides, ne s'imposaient pas au monde savant. Chacun restait libre, semble-t-il, de les accepter ou de les rejeter. C'est pourquoi la plupart des cours du ^{xvii}^e siècle ne regardent pas la question comme tranchée, mais énumèrent simplement les diverses explications de la pesanteur qui ont été proposées. Il se peut — dit une thèse (1) de 1685 — que ce soit le mouvement même qui engendre l'accélération, ou bien que la cause mouvante (cause, quelle qu'elle soit, de la pesanteur) imprime au mobile une *qualitas impressa* ou *impetus*, ou bien que le mouvement des graves soit entretenu et accéléré par l'action de l'air. Réduites à des affirmations aussi vagues, les trois hypothèses se laissent concilier, l'une aussi bien que l'autre, avec la loi de GALILÉE (hauteur de chute proportionnelle au carré du temps). Et cette loi peut tout aussi aisément être mise d'accord avec la théorie qui fait dépendre l'accélération de l'attraction : encore que l'on ignore la cause de la « plus grande vitesse » des corps qui tombent, écrit MERSENNE (2) à propos des résultats de GALILÉE. « l'on peut néanmoins expliquer quelques raisons qui satisferont à plusieurs personnes, soit que la pesanteur des corps les pousse en bas, que l'air les chasse hors de son lieu, que la terre les attire, ou que ces trois causes et plusieurs autres contribuent à cet effet ». Aussi voyons-nous la loi mathématique de GALILÉE communément admise dans la deuxième moitié du ^{xvii}^e siècle par ceux-là mêmes qui ne repoussent pas absolument les théories aristotéliennes (« cette proportion admirable qu'il y a entre la hauteur et le temps de chute ne peut être mise en doute par personne », dit la thèse de 1685 déjà citée). Mais, puisque loi et théorie ne s'impliquent pas nécessairement l'une l'autre, la théorie n'a plus en réalité de rôle à jouer. Elle devient plutôt une gêne et l'on va bientôt juger bon de l'abandonner. Déjà l'auteur de

(1) La thèse de PONTCHARTRAIN, citée plus haut. La troisième explication indiquée ci-dessous est admise concurremment avec la première ou la deuxième par l'auteur de thèses soutenues dans une discussion publique qui eut lieu à Pont-à-Mousson en 1622 (*Selectæ propositiones in tota sparsim mathematica pulcherrimæ*, Bibl. Nat. V. 8424) et par GASSENDI dans ses premiers ouvrages (voir les *Epistolæ tres de motu impresso*, 1641).

(2) *Traité des mouvemens*, 1633.

thèses (1) soutenues à Liège en 1603 déclare que l'opinion la plus vraie est l'opinion commune, d'après laquelle « c'est le mouvement précédent qui est la cause de la vitesse plus grande prise par le mouvement suivant ». Or cette opinion ne peut vraiment pas être regardée comme une explication ou une théorie. Ce n'est, en somme, que la constatation même du fait de l'accélération.

La loi du mouvement parabolique des projectiles s'introduit dans l'enseignement (2) tout aussi aisément que celle de la chute verticale. On sait qu'après divers tâtonnements les auteurs du Moyen âge et de la Renaissance, se fondant sur la distinction radicale qui sépare selon eux le mouvement naturel du mouvement violent, s'étaient presque tous arrêtés à une figure de la trajectoire du projectile formée de deux segments rectilignes réunis par un arc de courbe, et fort semblable à une parabole. Les conceptions qui ont guidé ces auteurs n'ont point contribué à préparer la démonstration de GALILÉE sur le mouvement parabolique. Elles nous en éloigneraient plutôt (3). Toutefois — venant après ces essais de solution du problème, assez heureux quant aux apparences données à la trajectoire et confirmés, semblait-il, par la pratique de la balistique — l'apparition de la parabole en la question paraît moins surprenante que si elle était survenue d'emblée.

Le problème des percussions (plus spécialement le problème ayant pour objet la mesure de l'action d'un maillet qui tombe sur un clou) tenait une place importante dans la plupart des cours de mécanique. Mais de ce problème aucune solution précise n'avait été donnée. Dans quelle proportion la force de percussion dépend-elle du poids du maillet et de sa vitesse ? On restait indécis entre diverses époques (4). Aussi la théorie des chocs de billes, qui est le fondement de la mécanique de DESCARTES et qui fut mise au point par HUYGENS, trouva-t-elle

(1) PETRUS BERTIUS, *De motu gravium et levium*, Liège, 1603.

(2) Cette démonstration repose sur une application particulière de la loi d'inertie, que (comme nous le verrons tout à l'heure) on ne peut mettre d'accord avec la doctrine du mouvement naturel (d'où l'ancienne physique voulait déduire la trajectoire cherchée) qu'à la condition de modifier profondément cette doctrine.

(3) Voir, par exemple, le *Dictionnaire mathématique* d'OZANAM, 1691, p. 334-335. Dans le cours du Père FABRI (voir *Tractatus physicus de motu locali*, rédigé par MOUSNIER, 1644) les voies sont préparées à l'introduction de la trajectoire parabolique.

(4) Voir notamment MERSENNE, *Cogitata physico-mathematica*, 1644, p. 72 et suiv., 85 et suiv., et également MONANTHEUIL, *loc. cit.*, p. 128 et suiv.

facilement moyen de s'insérer dans la physique des écoles (1), bien que son auteur principal eût eu au contraire pour dessein de l'opposer à cette physique.

Si nous en venons maintenant aux questions plus délicates touchant aux premiers principes de la mécanique, nous voyons la transformation des théories s'accomplir d'une manière analogue, quoique avec plus de lenteur et de résistance.

La doctrine *du lieu*, par exemple, appliquée au mouvement des astres et au mouvement centripète des graves, continue longtemps à être enseignée, bien qu'elle se réduise au ^{xviii}^e siècle à quelques propositions extrêmement vagues. L'*ordre du monde* demande — écrit FOREST-DUCHESNE, professeur de rhétorique, mathématique, philosophie et théologie (2) — qu'autant qu'il est possible les corps graves soient en bas et les corps légers en haut. Ainsi les mouvements naturels des corps sont des mouvements qui ont pour but de rétablir (le plus directement possible, donc en ligne droite) l'ordre de la nature lorsque celui-ci a été troublé. Dans le vide il n'y aurait aucun mouvement naturel des corps graves ou légers, parce qu'il ne pourrait y avoir aucun désordre à réparer; un corps situé dans le vide ne serait donc ni grave ni léger. Le Père FABRI, dans son cours de physique (3), enseigne une doctrine analogue. Le grave se meut naturellement de façon à atteindre le lieu qui lui est assigné (*ut suam finem consequatur*), c'est-à-dire de façon à aller vers le bas. Dans le vide absolu il n'y aurait ni haut ni bas et aucun grave ne se mouvrait naturellement. Mais cette explication de la pesanteur ne joue plus, dans le système de physique enseigné par le Père FABRI, aucun rôle important. Elle n'est là, pour ainsi dire, que pour mémoire. Le Père FABRI déduit en fait les propriétés des corps graves d'un ensemble de définitions qui énoncent les mouvements constatés sans rien postuler sur la cause de ces mouvements. C'est sur de semblables définitions que les thèses de doctorat citées plus haut fondent la théorie des graves, et, dans ces thèses, les lois non établies par l'expérience ne sont rapportées que

(1) Elle est exposée en détail dans un cours de mécanique (*Abrégé de mécanique*) que nous citons plus bas. Cf., également, les *Dialogi physici* du P. FABRI, 1669, et un cours de physique professé à Paris vers 1700 par LE MONNIER, professeur de philosophie.

(2) *Selectæ dissertationes physico-mathematicæ*, 1647, p. 156 et suiv.

(3) *Physica*, Lyon, 1669, t. I, p. 241 et suiv.

comme des propositions douteuses (1) (*incertum est...*). « On ne saurait dire » si les graves se portent vers le centre de l'univers, s'ils tombent vers la terre à quelque distance qu'ils soient placés de celle-ci, si, parmi les corps du ciel, les uns tendent à s'approcher du centre de la terre, les autres à s'en écarter, si la gravité et la légèreté sont deux principes distincts (2), etc. Et l'on se contente donc de définitions comme celles-ci (3) : Parmi les corps, ainsi que nos yeux le constatent, il en est qui se meuvent vers le bas : ils sont dits *graves*; d'autres se meuvent vers le haut, ils sont dits *légers*, d'autres encore se meuvent autour d'un centre, ils sont dits *célestes*. Désormais la porte est ouverte à des explications nouvelles : on est libre de donner comme cause à la pesanteur l'*attraction de la terre* (explication admise par GASSENDI, ROBERVAL, mais qui ne semble pas avoir trouvé grande faveur dans l'enseignement français au XVII^{me} siècle) ou, à l'instar de DESCARTES, certains mouvements tourbillonnaires. De fait, la théorie cartésienne des tourbillons, plus ou moins altérée il est vrai, s'est, comme on sait, rapidement répandue dans les écoles françaises (4).

Nous voyons par les exemples qui précèdent comment les théories et les hypothèses devenues caduques s'éliminent peu à peu, sans bruit, pour faire place à d'autres. Dans certains cas, le processus de transformation est un peu différent, et il est plus curieux encore. Certaines théories vétustes, au lieu de disparaître, s'affirment au contraire autant que jamais, mais se métamorphosent, changent de sens, de

(1) Thèses de PONTCHARTRAIN, citées plus haut (1685). Cf. le *Cursus mathematicus* de DECHALES (t. I, p. 432 et suiv.).

(2) On savait au moyen âge (comme l'a montré DUHEM) que l'on peut, sans rien changer à ce que l'on enseigne sur les mouvements des corps graves et légers, admettre que la légèreté n'est point une qualité positive, mais seulement une moindre gravité. Cette manière de voir est la seule correcte d'après le cours de LE MONNIER cité plus haut (vers 1700). Dans le traité du Père CASATI (Lyon, 1684) il est affirmé au contraire que la légèreté est une qualité positive. Beaucoup de traités, comme celui de FOREST-DUCHESNE, laissent la question dans le vague.

(3) Thèses de PONTCHARTRAIN. Dans ses *Traité de mécanique* (1679), le Père LAMY procède d'une manière analogue.

(4) Dans l'enseignement de LE MONNIER (vers 1700), elle est devenue partie intégrante du cours de physique. Déjà le Père FABRI enseigne dans sa *Physica* (t. I, 1669, p. 240) qu'aucun corps ne peut descendre sans qu'un autre monte en même temps (mouvement circulaire de DESCARTES).

manière à s'adapter à des conséquences nouvelles. C'est le cas pour la doctrine du *mouvement naturel*, qui, grâce à une ingénieuse interprétation, se mue en un principe nouveau où l'on voit poindre la loi moderne de l'*inertie*.

On sait que la physique ancienne attachait une importance capitale à la distinction du *mouvement naturel* (rectiligne pour les corps terrestres, circulaire pour les astres) et du *mouvement violent*. Mais cette physique enseignait, d'autre part, que les mouvements parfaits sont les mouvements uniformes, et, à ce titre, il semblait que tout mouvement naturel dût être uniforme (ou composé de mouvements uniformes). Comment expliquer alors que la chute naturelle d'un grave soit accélérée? Nous avons rappelé tout à l'heure les causes que l'on imaginait pour rendre compte de cette accélération. ARISTOTE, en particulier, la croyait due à la poussée de l'air, ce qui, au fond, revenait à admettre (sans qu'on le dit expressément) que le mouvement de chute dépend en partie d'une action violente, celle de l'air en contact. Cependant le moment vient où la loi précise de la chute des graves est formulée, et la conviction s'impose que l'accélération est le résultat d'une action de la pesanteur elle-même. GALILÉE constate, d'autre part, que, sur un plan horizontal, si l'on fait abstraction des résistances, tout mouvement uniforme se perpétue de lui-même indéfiniment sans qu'il faille aucune cause (pesanteur ou autre) pour l'entretenir. Bientôt après DESCARTES rend extrêmement vraisemblable cette idée, que les astres eux aussi tendent à conserver vitesse et direction, et que c'est la combinaison d'un mouvement d'inertie avec un mouvement centrifuge ou centripète qui produit leur cause curviligne. Comment faire entrer ces faits dans le cadre de l'ancienne théorie? On y parvient en franchissant une série d'étapes successives, presque insensibles.

Nous nous rappelons que, d'après les physiciens parisiens du *xiv^e* siècle (1), le corps grave qui tombe serait le siège d'un *impetus* qui va continuellement en s'accroissant. Du jour où ils furent familiarisés avec la loi quantitative de l'accélération, les adeptes de cette doctrine admirent tout naturellement que chaque nouvel accroissement d'*impetus* consiste en un degré de vitesse constant qui se perpétue indéfiniment tant qu'aucune cause étrangère ne l'affecte (2).

(1) Cf. DUHEM, notamment dans ses *Études sur LÉONARD DE VINCI*, 3^e série, 1913.

(2) Cf. les thèses de PONTCHARTRAIN, la *Physique du Père FABRI*, t. I, p. 246, etc.

en sorte que, par l'addition d'*impetus* égaux dans des temps égaux, le mouvement accéléré se produit suivant la formule de GALILÉE. Ainsi se trouve affirmée la loi de la conservation de la vitesse pour le mouvement rectiligne résultant d'un *impetus* unique. Loi qui est encore fort loin, toutefois, de notre principe d'inertie, car l'*impetus* est considéré par la plupart des auteurs comme une sorte de qualité active, ou de vertu imprimée dans le corps, laquelle est très analogue à la « tendance naturelle » d'ARISTOTE (1). Cette vertu est regardée comme la cause qui entretient la vitesse du grave, et c'est encore par une vertu semblable — ayant la propriété de mouvoir les corps en cercle — que l'école de BURIDAN explique la course des astres. Mais, laissant de côté ces considérations, retenons simplement l'idée générale, très naturelle (et très vague d'ailleurs), de l'addition des *impetus*. De cette idée, un pas facile à franchir nous conduit à la doctrine qui est énoncée par MONANTHEUIL (2) : *Le mouvement vraiment naturel — celui qui se produit sans intervention d'un agent extérieur — est le mouvement rectiligne* (Omnis motus naturalis est per rectam de centro ad locum). Mais, alors, le mouvement des astres, le mouvement accéléré des graves devra-t-il donc être regardé comme un mouvement violent? On s'achemine en effet vers cette idée. « Si l'on demande — dit MONANTHEUIL — pourquoi le ciel se meut circulairement, je répondrai qu'il se meut ainsi, non naturellement, mais par l'effet d'une volonté. Cette volonté est celle d'une intelligence qui gouverne le monde comme notre âme gouverne notre corps. » Et FOREST-DUCHESNE, se servant adroitement de la doctrine (3) des âmes célestes, enseigne (4) que, dans chaque astre, Dieu a logé un ange qui préside à sa course. Ainsi le mouvement d'un astre est, à la lettre, celui d'un corps poussé par un agent étranger. L'*impetus* imprimé à

(1) GIOVANNI DE GUEVARA dans ses *In ARISTOTELIS Mechanicas commentarii*, Rome, 1627, consacre un chapitre à démontrer que la théorie de l'*impetus* n'est pas en désaccord avec la physique d'ARISTOTE (p. 261 et suiv.).

(2) ARISTOTELIS *mechanica*, p. 104. MONANTHEUIL ne se prononce pas, par contre, sur la question de la conservation de la vitesse, et, en un autre passage de son traité (p. 202), il admet, avec beaucoup d'autres auteurs, que l'*impetus*, du moins l'*impetus* violent imprimé à un projectile, s'affaiblit peu à peu comme la chaleur que l'on imprime dans un morceau de fer.

(3) Notamment de la doctrine enseignée par NICOLAS DE CUSE.

(4) *Selectæ dissertationes*, 1647, p. 148 et *passim*. Cf. le *Discours sur le mouvement local* du Père PARDIES (2^e édit., 1674, p. 43).

un corps terrestre n'est lui-même — selon le cours de LE MONNIER (1) — que la *puissance divine* imprimée au mobile, et c'est pourquoi il persévère indéfiniment : l'addition des *impetus* dans le grave qui tombe est par conséquent l'effet d'une action extérieure, — de l'action divine.

Ainsi l'on en vient à enseigner positivement que la chute du corps pesant est bien, en réalité, un mouvement violent. Et, dans les thèses de 1685 que nous avons déjà plusieurs fois citées, nous voyons enfin l'action de la pesanteur devenir le type même de l'action violente, en sorte que l'on nous propose de définir une force quelconque comme étant l'agent ou la cause produisant un mouvement uniformément accéléré (c'est-à-dire accéléré dans la proportion qui caractérise la pesanteur). Si l'on admet cette définition de la force et du mouvement violent, l'expression « mouvement naturel » devient alors synonyme exact de « mouvement non accéléré » ou « mouvement d'inertie ».

Tel est, en gros, l'artifice grâce auquel le principe d'inertie peut être introduit dans la mécanique ancienne. Le mot « artifice », certes, n'est pas trop fort ici, car aucune évolution naturelle de la science n'aurait pu aboutir, croyons-nous, à la métamorphose qui vient d'être décrite. La doctrine qui fait du mouvement de la pesanteur un mouvement violent est en réalité inconciliable avec les principes d'ARISTOTE. Elle détruit, en effet, les fondements mêmes de la distinction établie entre les mouvements naturels et les mouvements violents. Prétendre maintenir cette distinction (2) tout en enseignant une pareille doctrine est manifestement un défi au bon sens. Aussi bien le vrai principe d'inertie n'a-t-il été nullement, dans l'histoire, l'aboutissement de la conception aristotélicienne du mouvement naturel, comme certains ouvrages d'enseignement pourraient le faire croire. Il n'est pas entré dans la science par la voie que nous venons de décrire. Mais il a été (incomplètement d'ailleurs) suggéré à GALILÉE (3) par l'expérience : il a été, d'autre part, imposé à GASSENDI par les problèmes de la

(1) Vers 1700 (voir plus haut). LE MONNIER enseigne que l'énoncé donné par DESCARTES du principe d'inertie n'est pas acceptable parce qu'il porte atteinte à la toute-puissance divine.

(2) OZANAM, dans son *Dictionnaire mathématique* de 1691, donne encore les définitions suivantes incompatibles avec l'idée d'inertie : « Le mouvement égal est le mouvement des corps célestes qui se meuvent en rond. Le mouvement inégal est le mouvement des corps terrestres, qui n'est pas uniforme. »

(3) Nous savons (cf. les études de DUBRE) que maints philosophes du moyen

théorie atomistique et dicté à DESCARTES par les exigences de son système.

L'analyse que nous venons de faire à propos de la notion de mouvement naturel pourrait être répétée dans bien d'autres cas. Considérons, par exemple, la notion de *moment*. A l'origine, le mot « moment » a un sens très large : c'est la puissance de mouvement que possède un corps eu égard aux conditions dans lesquelles il est placé (1), aux liaisons auxquelles il est soumis [dans le cas particulier d'un corps suspendu au bout d'un bras de levier horizontal, le moment se trouvera être égal au poids du corps multiplié par la longueur du bras]. De cette acception très générale, que l'on particularise et que l'on précise, on passe par degrés insensibles à la définition mathématique que nous donnons aujourd'hui du *moment statique*.

Le mot si fréquemment employé d'« impetus » donne lieu à des observations semblables. En en suivant la fortune, on verrait comment l'*impetus*, qui est originellement une vertu, une qualité imprimée dans un corps, devient, à un certain moment, une *quantité*, la quantité de mouvement de DESCARTES (2).

A mesure, d'ailleurs, que le sens des notions se dégage, les théories qui servaient primitivement à les étayer deviennent superflues, et disparaissent plus ou moins vite. Ainsi, en particulier, une fois venu le

âge avaient observé avec attention certains effets d'inertie (par exemple la tendance qu'a une meule à continuer à tourner indéfiniment). Mais leurs observations n'étaient pas suffisantes pour leur permettre d'en tirer avec certitude des conclusions semblables à celles de GALILÉE. Ajoutons que le moyen âge (et GALILÉE lui-même à un certain point de vue) croyait que la tendance du mouvement uniforme à se conserver peut exister pour le mouvement circulaire aussi bien que pour le mouvement rectiligne.

(1) C'est ainsi que MERSENNE interprète la notion de « moment » dans son exposé de la statique de GALILÉE (*Les Mécaniques de GALILÉE*, 1634, p. 7).

(2) La mécanique des fluides — que j'ai laissée de côté dans cet article — donnerait lieu à des constatations semblables. Dans les ouvrages du Père NOËL, par exemple, on voit s'opérer le passage entre la théorie scolastique des fluides et la théorie de DESCARTES. — Également instructive est la métamorphose du *centre de violence* d'un corps (point faisant pendant au centre de gravité dans la doctrine qui fait de la gravité naturelle et du mouvement violent deux principes opposés) : au XVII^e siècle, ce point devient le *centre d'agitation*, et bientôt le *centre d'oscillation du pendule composé* (cf. DUHEM, *Études sur LÉONARD DE VINCI*, 1^{re} série, p. 108 et suiv., 147 et suiv.).

jour où l'on dispose des lois mathématiques du mouvement des graves, — du principe de la conservation de la vitesse (introduit comme nous l'avons vu tout à l'heure), — d'une définition précise de la quantité de mouvement et de la théorie élémentaire des chocs, on peut, franchissant un dernier pas, laisser tomber tout le reste : on a alors une théorie dynamique — celle de DESCARTES, revue en ce qui concerne les lois du choc, et complétée par les lois de GALILÉE — qui est parfaitement cohérente et est devenue aussi purement mathématique que le sont les cours de statique. Ce dernier progrès est réalisé (vers la fin du XVII^{me} siècle, sans doute) dans un cours « abrégé » de mécanique dû peut-être à SAUVEUR et qui se trouve parmi les manuscrits de la Bibliothèque Nationale (1).

Avec cet *Abrégé de mécanique* précis et concis — le plus moderne et le plus remarquable des cours que j'ai examinés dans les pages qui précèdent — nous touchons au terme de l'évolution qui a transporté la mécanique du domaine de la physique et de la philosophie dans celui de la géométrie et de l'algèbre. Sans doute bien des maîtres continueront longtemps encore à regarder la théorie des mouvements comme une partie de la philosophie (c'est ainsi qu'elle se présente dans le cours de (2) LE MONNIER cité plus haut. Mais le lien qui rattache cette théorie au reste de la physique est devenu désormais extrêmement lâche et artificiel.

Du point de vue mathématique, par contre, — n'oublions pas de le remarquer — la théorie dynamique exposée dans l'*Abrégé de mécanique* que je viens de citer aura encore beaucoup à progresser pour rattraper la science, qui à la fin du XVII^{me} siècle marche à pas de géant. Dans ce traité, la notion précise de vitesse instantanée (vitesse en un temps t) ne se trouve pas encore (3). La notion de *force* — étrangère, comme on sait, à la dynamique cartésienne qui est

(1) *Abrégé de mécanique*, fonds français 14750. Deux autres cours manuscrits presque identiques se trouvent à la Bibliothèque Nationale, et celui qui paraît le dernier en date est donné comme étant le cours professé par SAUVEUR (1653-1716). Outre les matières dont je viens de faire mention, ces cours contiennent une théorie du mouvement des corps fluides fondée sur les lois du choc.

(2) Vers 1700 (voir plus haut). La théorie cartésienne des chocs occupe la place d'honneur dans les chapitres du cours de LE MONNIER consacrés à la mécanique.

(3) La vitesse d'un corps est simplement définie comme « le plus ou moins de chemin que le corps fait pendant un certain temps ».

fondée uniquement sur la considération des chocs — est absente (1). La *direction* du mobile (« ligne qu'il parcourt ou tend à parcourir (2) ») est encore distinguée de la vitesse (qui, dès lors, n'est qu'un nombre). La notion de *vitesse* ou plutôt de *direction* est présentée en des termes qui rappellent encore trop les anciennes distinctions scolastiques (on nous dit, en effet, que la *direction* est *simple* lorsqu'il n'y a qu'une cause tendant à mouvoir le corps, composée lorsqu'il y a plusieurs causes en présence). Les lois du choc et la distinction des corps élastiques et non-élastiques ne sont pas établies complètement (3). Il reste, on le voit, pas mal à faire pour mettre cet enseignement d'accord avec les travaux de HUYGENS, de NEWTON, de LEIBNIZ. Ce sera là l'œuvre des maîtres du XVIII^me siècle.

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(1) Le mot « force » apparaît, il est vrai, exceptionnellement en quelques passages, mais seulement comme synonyme de « quantité de mouvement ».

(2) On remarquera la précaution prise ici pour pouvoir appliquer à des mouvements virtuels la définition donnée. La considération de tels mouvements était classique.

(3) On n'y traite que le cas peu intéressant des corps absolument inélastiques cas étudié en détail par WALLIS).

The development of trigonometric methods down to the close of the XVth century.

(With a general account of the methods of constructing tables of natural sines down to our days.)

This paper serves as an introduction to a study on RICHARD WALLINGFORD's *Quadripartitum* which will be published (with notes and translation) in an ulterior number of *Isis*. My study of the *Quadripartitum* was undertaken in the summer of 1918 at the suggestion of Professor L. C. KARPINSKI of the University of Michigan, who had himself made a preliminary examination of the manuscript. The introduction is largely based on the late A. VON BRAUNMÜHL's *Vorlesungen*. It treats the evolution of the methods of plane trigonometry from the earliest times to the close of the fifteenth century. However, since WALLINGFORD makes the methods of calculating tables of sines and chords the central feature of Part I of the *Quadripartitum*, it has seemed advisable not to limit in point of time the treatment of the methods of constructing tables of natural sines.

The whole work, as published in this and following numbers of *Isis*, was submitted as a thesis in partial fulfillment of the requirements for the degree of Doctor in Philosophy in the University of Michigan, 1920. To Professor L. C. KARPINSKI my thanks are due for very helpful directions and criticism throughout the preparation of this dissertation.

In the construction of their pyramids, nearly all of which had their faces inclined approximately 32° to the horizontal, the ancient Egyptians employed the practical equivalent of trigonometric functions. As interpreted by CANTOR (1). $DF \Leftarrow pir em us$ (fig. 1),

(1) CANTOR, *Vorlesungen über Geschichte der Mathematik*, 2nd Edition, vol. 1, p. 59-60. Leipzig, 1898,

DC = *qai en haru*, 2CF = *uxa tebt*, 2CE = *senti*. But *segt*, « the ratio number », in one plane is $\frac{1/2 \text{ uxa tebt}}{\text{piremus}} = \frac{\text{CF}}{\text{DF}} = \cos \text{DFC}$ and in the other it is $\frac{\text{qai en haru}}{1/2 \text{ senti}} = \frac{\text{CD}}{\text{CE}} = \tan \text{DEC}$. The stone-cutters of the pyramids probably used the term *segt* somewhat as modern carpenters use the word *pitch* in sawing rafters. « The sockets cut into the limestone surface of the desert plateau in which the cornerstones of the Great Pyramid were laid... enabled PETRIE to establish the length of the sides as 755 feet. The maximum error he found to be 0.63 of an inch, that is, less than one fourteen-thousandth of the total length of the side. The error of angle at the corners he found to be 42" of a degree, that is, one twenty-seven thousandth of the right angle which the architect had laid out at the corner » (1).

With this glimpse at the earliest trace of our science we must turn to astronomy or astrology for further development. In fact it was only with the object of perfecting astronomical calculations that trigonometry was cultivated at all for some 3000 years. The first independent treatise on trigonometry is that by AR-TUSI of Bagdad in the thirteenth century, while two centuries more passed before a similar work appeared in Europe. Because of the interest in astronomy, spherical trigonometry was developed prior to the plane, but we shall limit our discussion to the latter.

A. VON BRAUNMÜHL (2) remarks that while in a papyrus of the early Egyptians was discovered the first trigonometric ratio we possess only fragmentary records of the early astronomical observations and computations. Doubtless the Egyptians and, probably earlier, the Chaldeans cultivated with devotion the pseudo-science astrology, as related by THEON OF SMYRNA. Among the early Chinese there are also traces of some idea of trigonometric ratio. But the first noteworthy development is to be found among the Greeks, who built their scientific structure upon the foundations erected by the Egyptians and the Babylonians. Indeed the earliest Greek mathematicians and astronomers were travellers who acquired their knowledge at the feet of

(1) BREASTED, 'The Origins of Civilization », *Scientific Monthly*, p. 91-92 January, 1920,

(2) A. VON BRAUNMÜHL, *Vorlesungen über Geschichte der Trigonometrie*, vol. 1, p. 3-6. Leipzig, 1900. Later references to this volume will be devoted simply by BRAUNMÜHL.

Egyptian and Babylonian priests. Thus THALES (640-548 B. C.) of Miletus, who spent many years in Egypt and became the first prominent mathematician among the Greeks, learned to determine from its shadow the height of a pyramid and from the similarity of triangles the distance of a ship from the harbor of Miletus.

ANAXIMANDER, contemporary and pupil of THALES, appears to have introduced into Greece the *gnomon* (sun-dial) of the Babylonians : from the lengths of the gnomon and its shadow the determination of the height of the sun leads to the tangent of its altitude.

But it is in the little book of 18 propositions *On the Sizes and Distances of the Sun and Moon* by ARISTARCHUS (about 310-230 B. C.) of Samos that we first find an attempt to calculate trigonometric ratios. HEATH (1) says : « Besides the formal assumptions at the beginning of the treatise, there lie at the root of ARISTARCHUS' reasoning certain propositions assumed without proof, presumably because they were generally known to the mathematicians of the day. The most general of the propositions are equivalent to the statements — If α is what we call the circular measure of an angle, and α is less than $\pi/2$, then (I) the ratio $\sin \alpha / \alpha$ decreases as α increases from 0 to $\pi/2$, but (II) the ratio of $\tan \alpha / \alpha$ increases as α increases from 0 to $\pi/2$. In propositions 7, 11, 12, 13, respectively, ARISTARCHUS reaches conclusions equivalent to the following : $1/18 > \sin 3^\circ > 1/20$, $1/45 > \sin 1^\circ > 1/60$, $1 > \cos 1^\circ > 89/90$, $1 > \cos^2 1^\circ > 44/45$ (2).

The statement of proposition 7, for example, is : « The distance of the sun from the earth is greater than eighteen times, but less than twenty times, the distance of the moon from the earth ». The assumption here is that at dichotomy the angle at the sun is 3° .

HIPPARCHUS, called by the Greeks the Father of Astronomy, was born at Nicea and lived in Rhodes and Alexandria during the period 161 to 126 B. C. That he was also the founder of the trigonometry of chords appears from two sources. THEON (about 365 A. D.) of Alexandria says that HIPPARCHUS wrote a treatise in 12 books on the calculation of chords in a circle, but no trace of this book has been found. Furthermore one work of HIPPARCHUS from a commentary on the astronomical work of EUDOXUS and ARATUS has come down to us, in which he says that he had proved graphically (PETAVIUS' translation

(1) HEATH, *Aristarchus of Samos*, p. 333, Oxford. 1913.

(2) BRAUNMÜHL, incorrectly gives here $1 > \cos 1^\circ > 44/45$, p. 8.

is « per lineas ») in an earlier work all that he used in the commentary (1).

From THEON we also learn that MENELAUS (about 98 A. D.) of Alexandria treated in 6 books the trigonometry of chords, but this book is also lost. However, Arabic and Hebrew translations of the *Spherics* of MENELAUS in 3 books have come down to us (2). Similar works of ANAXIMANDER (about 611 B. C.), AUTOLYCUS (about 330 B. C.), EUCLID (about 320 B. C.), HYPISICLES (about 180 B. C.) of Alexandria, and THEOBOSIUS (first century B. C.), of Tripoli contain not a trace of trigonometric computation. But MENELAUS' *Spherics* gives in great completeness the geometric theorems on which Greek trigonometry is built and in the last book treats of the relations between chords and arcs. The first theorem in the second book, generally known as the Theorem of MENELAUS, is the foundation of the laws of the spherical trigonometry that obtained until trigonometry twelve or fourteen centuries later broke the shackles that bound it to astronomy.

The Theorem of MENELAUS may be stated thus : The product of the three ratios of the consecutive segments of the sides of a plane triangle made by any rectilinear transversal equals unity.

Let the transversal intersect the sides of triangle ABC in the points D, E, F (fig. 2). Dropping from A, B, C perpendiculars AM, BN, CP to line FD, we have by similar triangles $\frac{AD}{DB} = \frac{AM}{BN}$, $\frac{BE}{EC} = \frac{BN}{CP}$, $\frac{CF}{FA} = \frac{CP}{AM}$.

Whence by multiplication $\frac{AD}{DB} \cdot \frac{BE}{EC} \cdot \frac{CF}{FA} = 1$, or as it is often written, $AD \cdot BE \cdot CF = DB \cdot EC \cdot FA$.

Now it is to be observed that if we consider the figure ABCDEF a complete quadrilateral, there are involved four distinct triangles and a transversal corresponding to each. But only two of these triangles are considered by MENELAUS, PTOLEMY, and their followers, for as we shall see in the next paragraph, their point of view was wholly different from ours. By them one ratio was always equated to the product of the other two. For example, $\frac{AD}{DB} = \frac{EC}{BE} \cdot \frac{CF}{FA}$, which is always stated

(1) See BRAUNMÜHL, « Beiträge zur Geschichte der Trigonometrie », *Abh. d. Kais. L.-P. Deutschen Akad. d. Naturforscher*, vol. LXXI. n. 1, p. 4, Halle, 1897.

(2) BJÖRNBO, « Studien über MENELAOS' Sphärik », *Abhandlungen zur Geschichte d. Math. Wis.*, vol. 14, p. 10. Leipzig, 1902.

in words just as we find it in the *Quadripartitum*: « The ratio of AD to DB is composed of the ratio of CE to BE and of the ratio of CF to FA » (1). If in the equation $AD \cdot BE \cdot CF = DB \cdot EC \cdot FA$ we divide by the product of BE, CF and each of the factors on the right successively, we obtain 3 distinct « composed ratios ». By interchanging the denominators on the right of these we obtain 3 other forms. Then because 6 different forms occur with each of the antecedents AD, BE, CF there are in all 18 « modes » to use the classic term employed by WALLINGFORD. THABIT IBN QURRAH (836-901, Bagdad) wrote a work on the « 18 modes » which is extant in the Arabic text and in Hebrew translations, besides Latin versions (2). In his *Liber Abaci* (1202) LEONARD OF PISA translated the Arabic *al-katta* (the cutter) as *figura cata* (3). Later writers evidently adopted simply the term *cata*, for we often find WALLINGFORD speaking of « arranging the *catha* » (or *chata* or *chatha*) for the solution of a particular problem. The ancient theory of the quadrilateral reaches its highest development in AT-TUSI's *Treatise on the Quadrilateral* (4).

The medieval point of view is found in the *Quadripartitum* of which Part III is devoted entirely to the treatment of the quadrilateral. WALLINGFORD says: « I shall draw the two lines AC and AD (fig. 3) from the point A and two other lines CE and DB from the extremities C and D and intersecting in a point G. Then I say that the ratio of AC to AB is composed of the ratio of CE to GE and of the ratio of DG to DB. From B I shall draw a line BF parallel to CG and in the proportion put GE between CE and BF. Then by the argument of Part II 2 (5) the ratio of CE to BF is composed of the ratios CE to GE

(1) The *regula sex quantitatum*, as this theorem was known when applied to the spherical quadrilateral, is obtained by changing the above lines to arcs and writing « The ratio of chord (2AD) to chord (2DB) is composed of the ratio of chord (2CE) to chord (2BE) and of the ratio of chord (2CF) to chord (2FA) ». It is well to observe that the period covered in this dissertation antedates the symbolic notation and the equation of modern algebra.

(2) BRAUNMÜHL, p. 46.

(3) CANTOR, *Vorlesungen*, vol. 2, p. 15, note 3.

(4) *Traité du Quadrilatère* attribué à NASSIRUDDIN-EL-TOUSSY d'après un manuscrit tiré de la bibliothèque de S. A. CARATHEODORY, Constantinople, 1891. Copy used was loaned by Prof. ALEXANDER ZIWET of the University of Michigan.

(5) Part III is devoted to the application to the *catha* of the theory of the « six quantities » developed in Part II. To us today much of this seems quaint and laborious, for modern methods have greatly simplified the processes.

and GE to BF. But by EUCLID, VI 4 the ratio of GE to BF equals the ratio of DG to DB. Hence the ratio of CE to BF is composed of the ratios CE to GE and DG to DB. But it is known by VI 4, that the ratio of CE to BF equals the ratio of AC to AB. Therefore the ratio of AC to AB is composed of the ratios CE to GE and DG to DB ».

This is the first of 18 cases of *conjunctive cattha*, corresponding to external section of the sides of the triangle; these are followed by the 18 cases of *disjunctive cattha*, corresponding to internal section of two of the sides. In the second of his two figures PTOLEMY (1) says that one shows « by division » (κατὰ διαίρεσιν) that $\frac{GE}{EA} = \frac{GZ}{DZ} \cdot \frac{DB}{BA}$ (fig. 4).

Evidently this is the source of the term *disjunctive* employed by WALLINGFORD. Thence naturally arose the opposite term for the former type.

We may pause here a moment to consider the purpose of the *Quadripartitum*. A perusal of Part I will show that the object in view is the calculation of tables of sines as given by Az-ZARQALI and, incidentally, tables of chords as given by PTOLEMY. Similarly the ultimate purpose of the remainder of the work is evidently the making of astronomical calculations with the use of the tables of sines. But although the author's primary interest in the work was astronomical, the form of it and various remarks show clearly that he was imbued with the scientific spirit and that he keenly felt the need of a solid mathematical foundation for such work. He complains of the lax methods of his predecessors. For example, in connection with his proof of the Theorem of MENELAUS for the spherical quadrilateral (p. 27, line 11) we read: « Then because the figure of the demonstration varies in three ways and PTOLEMY touched only one of them, in order that we may leave nothing incomplete... let us pursue all three modes » (2). Again (p. 33, line 8) he says: « But first observe that in the *Canones* of ARZACHEL (Az-ZARQALI) and others the doctrine of this operation (of finding celestial latitude) is not to multiply mean by mean and divide by the first (term of the proportion) but to multiply the first by the third and to divide by the second... » Clearly WALLINGFORD is here endeavoring to make sure of the mathematical basis of his own work.

(1) *Almagest*, Edition HALMA, vol. 1, p. 51.

(2) Compare BJÖRNBO, « Studien über MENELAOS' Sphärik », *Abhandlungen zur Gesch. d. Math. Wis.*, vol. 14, p. 88-92. Leipzig, 1902.

CLAUDIUS PTOLEMY who made astronomical observations in Alexandria during the period 125-161 composed in Greek a work of 13 books commonly called the *Almagest* (1) which holds in astronomy the place held in pure mathematics by the *Elements* of EUCLID. It is safe to say that all astronomical tables for more than a millennium were based on the *Almagest*. We are chiefly concerned with the first book, in which the mathematical foundation of the work is laid.

PTOLEMY divides the circumference into 360 *degrees* and the diameter into 120 *parts* and then subdivides each *part* into *minutes*, *seconds*, *thirds*, etc. (*partes minutæ primæ*, *partes minutæ secundæ*, *partes minutæ tertiæ*, etc.) in the sexagesimal system of the Babylonians with which we are today familiar in the subdivisions of the degree and the hour. He assumes the ratio of the circumference of a circle to its diameter to be $3^{\circ} 8' 30''$, that is $\pi = 3 + 8/60 + 30/60^2 = 377/120 = 3.14166$ (2).

In the *Almagest* are found 4 fundamental principles used by PTOLEMY to calculate his table of chords for intervals of $30'$ of arc (3).

(I) By the theorems of EUCLID are found the sides of the regular triangle, quadrilateral, pentagon, hexagon, and decagon in *parts* of which 60 make the radius. In reverse order the values obtained are : $\text{chd } 36^{\circ} = 37^{\text{p}} 455''$, $\text{chd } 60^{\circ} = 60^{\text{p}}$, $\text{chd } 72^{\circ} = 70^{\text{p}} 32' 3''$, $\text{chd } 90^{\circ} = 84^{\text{p}} 51' 10''$, $\text{chd } 120^{\circ} = 103^{\text{p}} 55' 23''$. Since the chords of supplementary arcs form with the diameter a right triangle, $\text{chd } 144^{\circ} = \sqrt{120^2 - (\text{chd } 36^{\circ})^2}$, and so for the supplement of any arc whose chord is known.

(II) The so-called Theorem of PTOLEMY, « The rectangle (product) of the diagonals of an inscribed quadrilateral equals the sum of the rectangles of the opposite sides », given in the form of a lemma, is used to find the chord of the sum or difference of two arcs. This theorem furnishes the results that we obtain by the addition and subtraction formulas. After proving the general theorem PTOLEMY uses the special case when one side is the diameter to find the chord of the difference of two arcs. To show how closely this is related to our trigonometry, we have (fig. 5) : $BG, AD = AG, BD = AB, GD$, that is $\text{chd } (AG - AB), 2r = \text{chd } AG, \text{chd } (180^{\circ} - AB) - \text{chd } AB$,

(1) All our references are to HAILMA's edition, Paris, 1813, which contains the Greek text and a French translation.

(2) *Almagest*, p. 413.

(3) *Almagest*, p. 28-36. See also BRAUNMÜHL, p. 19-21.

chd ($180^\circ - \text{AG}$), which is PTOLEMY's formula. If now we put angle $\text{AEG} = 2\alpha$, angle $\text{AEB} = 2\beta$, and $r = 1$, we have $\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$ (1). The fundamental difference is that our notion of ratio does not enter into the trigonometry of the Greeks or the Arabs. They dealt with the lengths of chords or half-chords (sinus) in a circle of known radius and it was more than eight centuries after PTOLEMY that the thought of making the radius unity occurred to an Arab, ABU'L-WEFA; still later by about six centuries a European, BÜRGI, conceived a like notion (2).

Similarly PTOLEMY finds from the chords of two given arcs the chord of their sum. Thus given (fig. 6) arcs AB, BG with known chords a, b , to find x , the chord of their sum. We have $x = \text{AG} = \sqrt{4r^2 - \text{GD}^2}$ and $\text{GD} = \frac{(a' \cdot b' - a \cdot b)}{2r}$. If we put $\text{AZB} = 2\alpha$, $\text{BZG} = 2\beta$, $r = 1$, the latter reduces to $\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$.

(III) The chord of the half arc is found from that of the arc as follows (fig. 7): Let $\text{DB} = a$ be the given chord, G the mid-point of arc BD, and AD a diameter. Make $\text{AE} = \text{AB} = a'$ and draw GZ perpendicular to AD. Then $\text{EG} = \text{BG} = \text{GD}$ and $\text{EZ} = \text{ZD} = \frac{(2r - a')}{2}$ where $a = \sqrt{4r^2 - a'^2}$. Whence PTOLEMY gets finally $\text{GD} = \sqrt{2r \cdot \text{ZD}}$. Making $r = 1$, arc $\text{BD} = 2\alpha$, and from the value of ZD obtaining $\text{GD} = \sqrt{r(2r - a')}$, we have $\sin \frac{\alpha}{2} = \sqrt{\left(\frac{1 - \cos \alpha}{2}\right)}$. By the use of this theorem are found from the chord of 12° the values $\text{chd } 3/2^\circ = 1^\circ 34' 15''$, $\text{chd } 3/4^\circ = 0^\circ 47' 8''$.

(IV) By means of an ingenious method of interpolation based on the principle (1) used by ARISTARCHUS, PTOLEMY finds $\text{chd } 1^\circ = 1^\circ 2' 50''$. Then by III. $\text{chd } 1/2^\circ = 0^\circ 31' 25''$. He now has the complete means of calculating his table of chords for differences of $30'$ of arc, with which he contents himself. We find that his table of chords is accurate to at least five decimal places throughout. For instance set-

(1) Compare TROPFKE, *Geschichte der Elementer Mathematik*, vol. 2, p. 226. Leipzig, 1903.

(2) For the development of the idea of ratio compare JACKSON, *Sixteenth Century Arithmetic in Columbia Contributions to Education*, Teachers College, Series 8.

ting $r = 1$ and observing that $1^p = 1/60$, we have $\sin 30' = 1/2$, $\text{chd } 1^\circ = 0^p 31' 25'' = 1885/3600^p = 1885/216000 = 0.0087268$ to seven decimal places, which agrees to six places with the correct value 0.0087265.

Improvement of mathematical tables has naturally gone hand in hand with the development of the science, but for our purpose it seems fitting to unify our discussion of trigonometric tables. Hence we shall conclude the treatment of this phase of the subject before proceeding further with the general development of trigonometric methods.

In the *Surya-Siddhanta* the Hindus, assuming $\alpha = 225' = \sin \alpha$ and proceeding for intervals of $225' = 3^\circ 45'$, gave rules equivalent to the formula (1), $\sin(n+1)\alpha = \sin(n\alpha) + \sin \alpha - \frac{\sin \alpha}{\sin \alpha} - \frac{\sin 2\alpha}{\sin \alpha} - \frac{\sin 3\alpha}{\sin \alpha} - \dots - \frac{\sin(n\alpha)}{\sin \alpha}$. By subtraction this becomes

$$\sin(n+1)\alpha = \sin(n\alpha) + \left[\sin(n\alpha) - \sin(n-1)\alpha - \frac{\sin(n\alpha)}{\sin \alpha} \right],$$

where $\sin(n\alpha) - \sin(n-1)\alpha$ is the first difference and $\frac{\sin(n\alpha)}{\sin \alpha}$ is the second. Here $r = 3438'$ and the results are in error less than $1''$ in the accompanying table. That the table was not constructed from the rules, but conversely, is shown by the fact that the tabular values exceed by $1'$ those given in some instances by the rules.

Using the Hindu *sinus* or half-chord, the Arabs were able to improve the Ptolemaic tables. ABU'L-WEFA (940-998, Bagdad) calculated a table of sines for intervals of $15'$ in which the error for $\sin 30'$ is only one unit in the ninth decimal place (2). From the sines of 36° and 60° , by the bisection of angles, he readily obtains the values of $\sin 18/32^\circ$, $\sin 15/32^\circ$, and $\sin 12/32^\circ = \sin(36^\circ - 30^\circ)/16$ and then, using the fact that for $90^\circ > \alpha + \beta > \alpha > \beta > 0$, $\sin(\alpha + \beta) - \sin \alpha < \sin \alpha - \sin(\alpha - \beta)$, finds $\sin 16/32^\circ > \sin 15/32^\circ + 1/3(\sin 18/32^\circ - \sin 15/32^\circ)$ and $\sin 16/32^\circ < \sin 15/32^\circ + 1/3(\sin 15/32^\circ - \sin 12/32^\circ)$. The arithmetic mean gives $\sin 1/2^\circ = \sin 15/32^\circ + 1/6(\sin 18/32^\circ - \sin 12/32^\circ)$,

(1) BURGESS, "Translation of the *Surya-Siddhanta*", *Journal of the American Oriental Society*, vol. 6, 1860, p. 196, ch. II, stanzas 15-16.

(2) WOEPCKE, "Mathématiques chez les Orientaux", *Journal Asiatique* Series V, vol. 15, 1860, p. 285 and fol.

a value too large by 0.00000 00010 00529 (1). The error arising from the formula of interpolation is about 6 times that of the quantities entering it but the error is only about 1/11 of that of the formula derived from PTOLEMY's method, namely, $\sin 1/2^\circ = 1/3(2 \sin 3/8^\circ + \sin 3/4^\circ)$ (2).

The last and probably the greatest of the Arabic astronomers was ULUG BEG (1393-1449, Samarcand) who found $\sin 1^\circ$ by means of his celebrated third-degree equation

$$x = \frac{\left(\frac{r^2}{4} \sin 3^\circ + x^3\right)}{\frac{3r^2}{4}}$$

in which he replaces x by $\sin 1^\circ$ and solves directly by a very ingenious method of approximation. For $r = 60$ the result in the sexagesimal system is of the form $x = a_0 + a_1/60 + a_2/60^2 + a_3/60^3 + \dots$, or as given in the *Prolegomènes*, $\sin 1^\circ = 1^\circ 2' 49'' 43''' 11''''$, a result correct to within 1/4 of $1''''$, that is within 4 units in the tenth decimal place (3). ULUG BEG's table of sines is constructed for intervals of one minute.

But in Europe little progress was made in advance of the tables of PTOLEMY until REGIOMONTANUS, following PEURBACH's construction of a table of sines with radius 600.000, used the radius 6.000.000 and later made the great step forward of employing a radius of 10.000.000, thus paving the way for decimal values with unit radius. Using $\sin 3/4^\circ + 1/3 \sin 3/4^\circ > \sin 1^\circ > \sin 3/4^\circ + 1/6 (\sin 6/4^\circ - \sin 3/4^\circ)$

(1) For complete geometric proof see BRAUNMÜHL, p. 56-57. But observe typographical errors. In the second of the above inequalities $15/32^\circ$ appears as $18/32^\circ$. Correctly written, $46^v 40^vi 50^vii = 0.00000 00010 00529$ and $\sin 1/2^\circ = 0.00872 65364 98903$. TROPFKE (vol. 2, p. 298) and CAJORI (*History of Mathematics*, 1919, p. 106) both give this value of $\sin 1/2^\circ$ as correct to the ninth decimal place instead of the eighth.

(2) WOEPCKE, "Discussion de deux méthodes arabes pour déterminer une valeur approchée de $\sin 1^\circ$ ", *Journal de Mathématiques*, vol. 19, 1854, p. 159 and fol.

(3) SÉDILLOT, *Prolegomènes des Tables astronomiques d'OLUG-BEG*, p. 81 and fol. Paris, 1853. Full treatment of the theory involved is given in the above article by WOEPCKE, p. 167 and fol. See also BRAUNMÜHL, p. 73, 74. For $r = 1$ and $x = \sin 1^\circ$ the equation becomes the well known relation $\sin 3^\circ = 3 \sin 1^\circ - 4 \sin^3 1^\circ$. We have here an illustration of the dependence of the trisection problem upon the solution of an equation of the third degree.

and $r = 6.000.000$, by the formula for the half angle he gets $52360 > \sin 1/2^\circ > 52358$. Whence $\sin 1/2^\circ = 52359$. For $r = 1$ this becomes $\sin 1/2^\circ = 0.0087265$, correct to 7 decimal places. The table is constructed for intervals of one minute (1).

The *Opus Palatinum de Triangulis* of GEORG JOACHIM RHAETICUS (1514-1576), finished at Neustadt in 1596 by his pupil, VALENTIN OTHO (1550?-1605), contains the natural values to 10 places (*i. e.* $r = 10^{10}$) of the six trigonometric ratios for every $10''$ sexagesimal. Correcting the work of RHAETICUS and OTHO, BARTHOLOMAEUS PITISCUS (1561-1613) published at Frankfort in 1613 his *Thesaurus mathematicus sive canon sinuum* containing the natural values of sines and cosines for $r = 10^{15}$ with the same interval of $10''$ (2). But with the invention of logarithms the following year and the subsequent publishing of logarithm tables, the use of tables of natural values of trigonometric functions largely ceased until the recent invention of calculating machines made natural tables again desirable (3).

In the meantime modern analysis has supplied for the construction of such tables manifold methods of computing and checking results. Among the few tables besides those of RHAETICUS that have been computed *de novo* undoubtedly the most notable (4) are the *Nouvelles tables trigonométriques fondamentales* calculated « without personal or mechanical assistance » during the period 1908-1914 by H. ANDOYER of the University of Paris. We shall merely outline the method of computing the natural sines and cosines as given by the author (5).

(1) For further consideration of the work of PEURBACH and REGIOMONTANUS see p. 40-43. BRAUNMÜHL believes that the above method, evidently based on the Arabic, is due to the influence of Az-ZARQALI (BRAUNMÜHL, p. 121).

(2) For detailed treatment of these works see BRAUNMÜHL, p. 212 and fol. RHAETICUS had himself begun the tables with $r = 10^{15}$. He was the first European to discard the arc for the angle by relating functions to the right triangle.

(3) Compare NAPIER *Memorial Volume*, p. 243 and fol. London, 1915.

(4) PETERS published in Berlin in 1911 a table of natural sines and cosines to 21 decimal places for every $10''$ sexagesimal.

(5) The entire work comprises about 1600 quarto pages. The logarithmic tables appeared in one volume in 1911. The natural tables are appearing in three volumes. Vol. 1 (1915) is described below; vol. 2 (1916) contains natural tangents and cotangents; vol. 3 will contain natural secants and cosecants and two auxiliary tables to assist in calculating cosecants and cotangents for angles less than 15° .

Using $\pi = 3.14159\ 26535\ 89793\ 23846\ 26433\ 8 +$ he calculates for convenience the first 50 multiples of π^2 and then obtains from the fundamental formulas of analytic trigonometry established by EULER

$$\begin{aligned}\sin(\pi/2)x &= 1.57079\ 63267\ 94896\ 61923\ 1321x \\ &\quad - 0.64596\ 40975\ 06246\ 25365\ 5756x^3 \\ &\quad + 7969\ 26262\ 46167\ 04512\ 0505x^5 \\ &\quad - 468\ 17541\ 35318\ 68810\ 0685x^7 \\ &\quad + \dots\dots\dots \\ &\quad - 18x^{27}\end{aligned}$$

and a similar series for $\cos(\pi/2)x$. Putting $x = y/100$ in these formulas and then giving y the values 1, 2, 3, ... 50, y being thus given in grades (*i. e.* in hundredths of a right angle) denoted by y^r , a 20-place table (II) of sines and cosines from 0° to 90° is obtained. This is followed by a table of the variations of these functions from the first to the eighth order inclusive. Next (1) using the $\sin y^r$ for $y = 0, 1, 2, \dots, 33$ and dividing the interval of this table into 6 equal parts, the values of $\sin(y \pm 1/2)$, $\sin(y \pm 1/3)$, $\sin(y \pm 1/6)$, $\sin(y \pm 5/6)$ are calculated; likewise the cosine. This gives a 17-place table for each $9'$ up to 30° . The values from 30° to 45° are found by the formulas $\sin(30^\circ + \alpha) = \cos \alpha - \sin(30^\circ - \alpha)$ and $\cos(30^\circ + \alpha) = \cos(30^\circ - \alpha) - \sin \alpha$ where α varies from 0° to 15° . From these results a table of differences for intervals of $18'$ from 0° to 30° is constructed to 20, 22, 24, 26, 28, 30 decimal places for the respective orders 1, 2, 3, 4, 5, 6 (2). Table IV A, containing the sines and cosines and their differences to 15 decimal places for every $10''$, is then constructed by means of interpolations from the preceding tables from 0° to 30° (3). To complete the table to 45° use is made of the formulas.

$$\Delta \sin(30^\circ + \alpha) = \Delta \cos \alpha + \Delta \sin(30^\circ - \alpha - h),$$

$\Delta \cos(30^\circ + \alpha) = -\Delta \sin \alpha - \Delta \cos(30^\circ - \alpha - h)$, where h designates an arc of $10''$ and $\Delta f(x) = f(x + 10'') - f(x)$ for all values of x . Besides the methods of procedure here outlined ANDOYER presents

(1) " It is not possible to interpolate directly in these tables (II) to construct by the method of differences the definitive tables which are the chief object of this work: the interval is too great. It is then necessary to construct other intermediary tables (III) which permit us to reach the desired goal. " P. XIII.

(2) For the method of reducing these differences for intervals of $10''$ see *Log. Tables*, p. XXIII-XXIV.

(3) For details see *Log. Tables*, p. XXVI-XXVII.

numerous methods that he used to check by other formulas the results already obtained.

Returning now to Hindu trigonometry, we find expressed in words relationships equivalent to $\sin^2 \alpha + \cos^2 \alpha = 1$ and $\sin^2 2\alpha + \text{versin}^2 2\alpha = (2 \sin \alpha)^2$ or $\sin \alpha = \sqrt{1/2(1 - \cos^2 \alpha)}$ where $r = 1$ (1). These formulas differ from PTOLEMY's in the use of the *sinus* (half-chord) instead of the whole chord. It was by the use of this more powerful instrument that the Arabs were enabled to build on the Greek foundation of the auxiliary trigonometry of chords the complete and independent trigonometry of the sine.

About the beginning of the ninth century of our era the caliphs of Bagdad gathered together men of learning and set them to translating into Arabic the scientific works of the Hindus and the Greeks. Before the century closed the labors of AL-KHWARIZMI (about 825), THABIT IBN QURRAH, and others had not only made these treasures accessible to the Arabs but had also given an impetus to independent investigation, as soon evidenced in the work of AL-BATTANI, ABU'L-WEFA, and later AT-TUSI.

In his *Opus astronomicum* (2) AL-BATTANI, known in medieval Latin works as ALBATEGNIUS (3), uses *sinus*, *sinus complementi* or *cosinus*, and *sinus versus* but follows closely the older Arabs in blending Greek and Hindu notions. He constructs his table of sines simply by halving the Ptolemaic chords. For determining the altitude of the sun by the shadow, *umbra extensa* (cotangent), of the *gnomon* (sun-dial) of 12 units length according to Hindu custom (cfr. VARĀHA MIHIRA, p. 34) he makes a table (4) for every 1° from 0° to 90° of parts and minutes

(1) VARĀHA MIHIRA, *Pañchasiddhāntikā*, edition THIBAUT, chap. IV, Verses 3, 4, p. 22.

(2) C. A. NALLINO, AL-BATTANI sive ALBATEGNI *opus astronomicum*, Pubblicazioni del Reale Osservatorio de Brera in Milano, N. XL, 1913, 1917. The text and annotations by NALLINO, an authority on Arabic science, are in Latin and occupy some 850 quarto pages.

(3) ABŪ ABD ALLAH MUHAMMAD IBN JĀBIR AL-BATTĀNĪ, called the PTOLEMY of the Arabs, made observations in Ar-Raqqā 879-918 and died in 929.

(4) A similar table but with numerous discrepancies of 1' is found in the Latin translation by ATHELARD of Bath of AL-MADJIRI's revision of the tables of AL-KHWARIZMI. (Compare NALLINO, Part II, p. 60, and SUTER, *Die Astronomischen Tafeln des MUHAMMED IBN MŪSĀ AL-KHARIZMĪ*, p. 174. "Copenhagen, 1914.") That contained in the *Alfonsine Tables* shows inaccuracies amounting to 40'. (RICO Y SINGRAS, vol. IV, p. 8.)

(sexagesimal). The *umbra recta* (or *extensa*) and the *umbra versa* seem to have been viewed as things wholly apart from *sinus* and *cosinus*. Not until the xvth century were they placed by Europeans in the same category by the adoption of a common radius. In addition to the formulas of the *Almagest* AL-BATTANI has expressions equivalent to $c : a = \sin \gamma : \sin \alpha$ and $b : a = \sin \beta : \sin \alpha$ but that he knew the general sine law seems doubtful (1).

In his *Almagest* (2), ABU'L-WEFA (3) explains the character of his work thus : « Although this subject has been treated by HIPPARCHUS, APOLLONIUS, PTOLEMY, and other eminent men of the ancients, we have followed in this book a method indicated by none of them... We have avoided the known methods that are difficult to understand, such as those of the quadrilateral and the six quantities. With the object of arriving at results most easily and directly... we have opened new views and furnished new proofs. We have also added several propositions, very useful in astronomy, which they did not mention ».

We find the equivalents both in *sinus* and in chords of the formulas $2 \sin^2 \alpha/2 = 1 - \cos \alpha$ and $\sin 2\alpha = 2 \sin \alpha \cos \alpha$. He also obtains geometrically $\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$ after having found by another method without being able to simplify

$$\sin(\alpha \pm \beta) = \sqrt{(\sin^2 \alpha - \sin^2 \alpha \sin^2 \beta)} \pm \sqrt{(\sin^2 \beta - \sin^2 \alpha \sin^2 \beta)}.$$

His proof of the last result is, however, very simple. That for $\alpha + \beta$ follows. Given arcs AB, BC (fig. 8), draw radii OA, OB, OC and to OA, OC the respective perpendiculars BT, BH and join HT. Then HT equals the *sinus* of arc AC. For prolong BT, BH to E, D and join ED. HT then equals half DE because T, H are the mid-points of BE, BD. Therefore arc DBE is twice arc CBA and HT is equal to the *sinus* of arc CA.

Furthermore the *umbra* is handled by him as a genuine trigonometric line and the following relations established : $\tan \alpha : 1 = \sin \alpha : \cos \alpha$; $\cot \alpha : 1 = \cos \alpha : \sin \alpha$; $\tan \alpha : \sec \alpha = \sin \alpha : 1$; $\tan \alpha : 1 = 1 : \cot \alpha$; $\sec \alpha = \sqrt{1 + \tan^2 \alpha}$; $\csc \alpha = \sqrt{1 + \cot^2 \alpha}$. Here we have replaced his *r* by unity. ABU'L-WEFA himself says :

(1) NALLINO, Part I, p. XLVII.

(2) CARRA DE VAUX, « L'Almageste d'ABU'L-WEFA ALBUZDJANI », *Journal Asiatique*, series VIII, vol. 10, 1892, p. 408-471.

(3) ABU'L-WEFA MUHAMMAD AL-BUZDJANI (940-998, Bagdad).

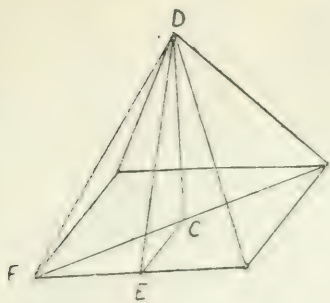


Fig. 1

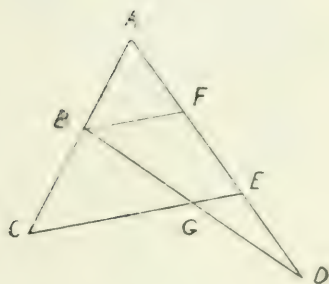


Fig. 3

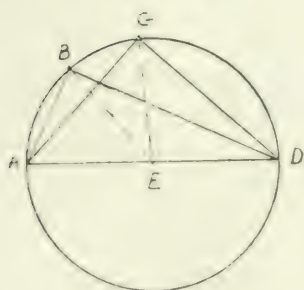


Fig. 5

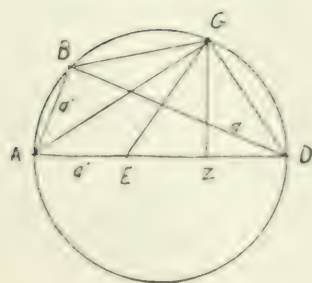


Fig. 7

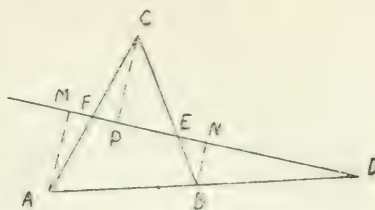


Fig. 2

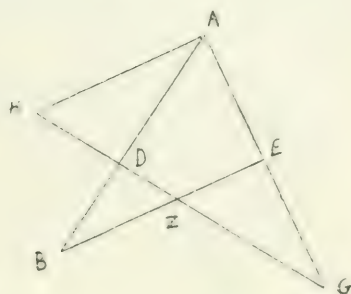


Fig. 4

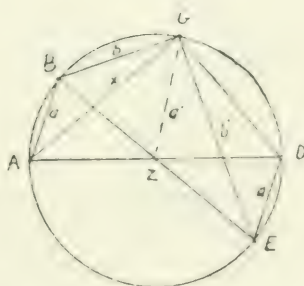


Fig. 6

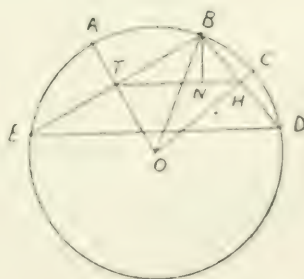


Fig. 8

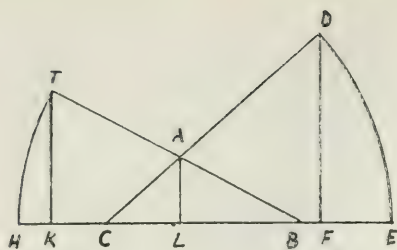


Fig. 9

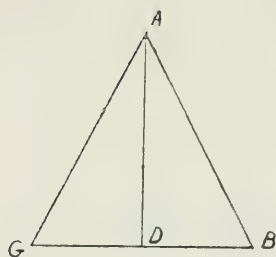


Fig. 11

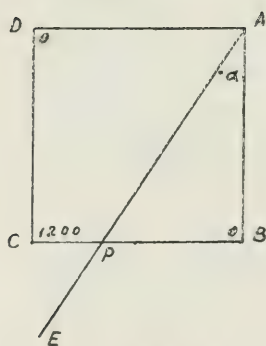


Fig. 13

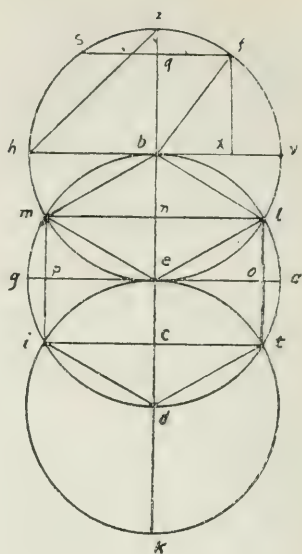


Fig. 10

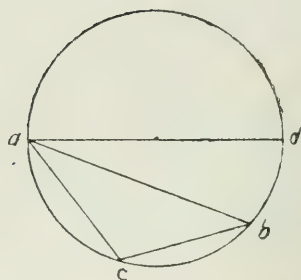


Fig. 12

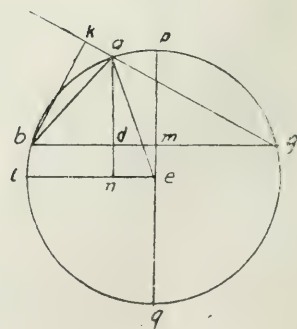


Fig. 14

« It is evident that if one takes the radius as unity the ratio of the sinus of an arc to the sinus of its complement is the tangent (first shadow), and the ratio of the sinus of the complement to the sinus of the arc is the cotangent (second shadow) ». (CARRA DE VAUX, p. 420.) Moreover he constructed a table of tangents and cotangents with the radius, subdivided sexagesimally, equal to unity, an idea ascribed by AT-TUSI to AL-BIRUNI (1). BRAUNMÜHL (p. 38) remarks that the above quotation can not be sufficiently emphasized, for in spite of its clear statement of the idea of setting $r = 1$, the radius was dragged along into the eighteenth century.

Contemporary with ABU'L-WEFA was IBN YUNUS (2), astronomer of Cairo and author of the *Hakimite Tables* which contained, according to HANKEL, the sum total of two centuries of development of Arabic astronomy and was the authoritative source for all later astronomers of the Orient. In his collection of rules, given without proof, is included the equivalent of the formula, $\cos \alpha \cos \beta = 1/2 [\cos(\alpha + \beta) + \cos(\alpha - \beta)]$ (3).

In addition to editing and revising many Greek and Arabic works, including a revision of the *Hakimite Tables*, AT-TUSI (4) wrote the important *Treatise on the Quadrilateral* (*Shakl al-Katta*). As previously mentioned, this is the first known work in which trigonometry is treated independently of astronomy. Moreover both plane and spherical trigonometry (5) are developed in great completeness.

The fourth book closes thus: « But the moderns, either from fear of confusion in the investigation of the different ratios and their varieties or to avoid the tedium involved in the use of composed ratios have devised easier methods to take the place of the quadrilateral. Also, once engaged in this study, we thought it useful to speak of these methods in order to give completeness to this branch of science ». Here for the first time in mathematical literature we find the explicit formulation of the sine law for the plane triangle. Two methods of proof for both the acute and the obtuse triangle are given. We shall reproduce one of the former.

(1) *Traité du Quadrilatère*, p. 165.

(2) ABŪ'L-HASAN ALIIBN YŪNUS (JŪNOS), active 1003.

(3) For probable method of proof see BRAUNMÜHL, p. 62-64.

(4) NAṢIR AD-DĪN AT-TŪSĪ (1201-1274, Bagdad).

(5) Of the 5 books of the *Treatise* the third is devoted to plane trigonometry and the fifth to spherical.

Let ABC (fig. 9) be the given triangle. Prolong CB to make $CE = 60 = R$. From the center C with radius CE describe an arc meeting CA produced at D , and from D drop DF perpendicular to CE . Similarly construct TK . Draw AL perpendicular to CB . Then by similar triangles $AB : AL = TB(R) : TK$ and $AL : AC = DF : DC(R)$. Thence $AB : AC = DF : TK = \sin ACB : \sin ABC$ (1).

Methods of solution of the triangle for all cases, with only one solution for the ambiguous case, are developed but where the sine law is inapplicable the procedure is to reduce to right triangles. An important feature of this work is the reproduction of the methods of proof of numerous predecessors of the author and statements concerning questions of priority. The chief difficulty encountered in studying the historical side of medieval mathematics is the failure of the authors to mention their sources of information.

We must now turn our attention to the West Arabs in Spain, for it was through this channel that mathematics flowed into medieval Europe. Although the East Arabs and the West Arabs possessed the same written language and religion, political animosities broke their free intercourse, so that the works of $ABU'L\text{-}WEFA$ and $AT\text{-}TUSI$ appear to have remained unknown in Europe to the time of $REGIOMONTANUS$. We shall find that science in Spain did not keep pace with the development in Bagdad.

$AZ\text{-}ZARQALI$ (2) was the most celebrated astronomer of his time. Under his direction a group of Moslem and Jewish scholars constructed the *Toledo Tables* which enjoyed an enormous circulation. The introduction to the tables, entitled *Canones sive regule super tabulas astronomie* (3) and containing besides the canons the explanation of the calculation of the tables, was written by $AZ\text{-}ZARQALI$ himself. $STEINSCHNEIDER$ records 48 Latin manuscripts of this work in European libraries besides numerous extracts and commentaries in Latin, Hebrew, and Arabic (4). He also observes that although the celebrated

(1) *Traité du Quadrilatère*, p. 70.

(2) ABU $ISHAQ$ $AZ\text{-}ZARQALI$ ($ARZACHEL$ of the Latins) made astronomical observations in Toledo 1061-1080.

(3) *Bibliotheca Mathematica*, Third series, vol. 1, p. 337 and fol. Leipzig, 1900. $CURTZE$ publishes here the Latin translation by $GERARD$ of Cremona.

(4) *Bullettino di Bibliografia e di Storia delle Scienze Matematiche e Fisiche*, published by $BONCOMPAGNI$, vol. 20, p. 6-32. Rome, 1887. This is one of a series of articles by $STEINSCHNEIDER$ on the life and work of $AZ\text{-}ZARQALI$.

Alfonsine Tables were constructed under the inspiration and guidance of King ALFONSO the Wise of Castile in the decade 1262-1272, most of these manuscripts were written after the middle of the XIIIth century. The climax of Az-ZARQALI's astronomical work was his *Safiha* (*saphea*) or universal astrolabe (1).

Having assumed the circumference of a circle to be 360° and the diameter 300', an innovation found in no previous work, Az-ZARQALI, following the Hindus, defines the *kardaga* (2) as the arc of 15°, the *sinus rectus* as the half-chord of twice the given arc, the *sinus totus* as the semi-diameter of 150', and the *sinus versus* as 150' less the *sinus* of the complement of the given arc (assumed < 90°). He then proceeds to give substantially the following description of the accompanying figure (fig. 10). Let the lines *ga* and *bd* intersect orthogonally in the center *e* of the given circle *abgd*, and with the centers *b*, *d* and the given radius let two other circles be described intersecting *abgd* in the points *m*, *l*, *t*, *i*. Then chords *lb*, *bm*, *me*, *el* are all equal, as also their arcs, and *en*, *nb* are each half the radius. Similarly *de* = *ce* = *en*. Hence *lt* = *mi* = *cn* = radius, and the circle *abgd* is divided into 6 equal parts.

Then *mp* (text gives *mq*) = sinus of 30° = 75' and *mn* = sinus of 60°. Since *zh* = $\sqrt{15000}$ is the chord of 90°, sinus of 45° = $\sqrt{11250}$. To find the chord of arc *lu* = 30° add the square of *lo*, the sinus of 30° to the square of *oa*, the difference between the radius and the sinus of 60°, and take the root (3) of the result. Then *la*/2 = sinus of 15°. Again if arc *fz* = arc *zs* = 15°, *fq* = sinus of 15° and *qb* = *fx* = sinus of 75°. Therefore sinus of 75° = $\sqrt{150^2 - fq^2}$. Now since 2 kardagas = 30° the sinus of 2 kardagas is 75' and the sinus of 4 kardagas is the root of the difference of the squares of the radius and the sinus of 2 kardagas. Similarly from *la*/2, the sinus of 1 kardaga, find the sinus of 3 kardagas. Then subtract the sinus of 15° from the sinus

(1) RICO Y SINOBAS, *Libros Alfonsies del Saber de Astronomia*, Madrid, 1864. The third of the five folio volumes is devoted to the construction and use of this instrument.

(2) AL-BIRUNI reports that *kardagia* used to mean an arc of 225', which is the arc the Hindus considered equal to its sine. The word is perhaps an alteration of the Sanscrit *cramadya*, which signifies *sinus rectus*. (REINAUD, « Mémoire géog., hist. et scientifique sur l'Inde », *Mémoires, Académie des Inscriptions et Belles-Lettres*, vol. 18, p. 313.)

(3) Here and later the square root is to be understood.

of 30° and the residuum is the sinus of the second kardaga. The difference between the sinus of 30° and the sinus of 45° is the sinus of the third kardaga, and so on (1). We find also the equivalent of

$$\sin 7^\circ 30' = \sqrt{\sin 30^\circ (\sin 90^\circ - \sin 75^\circ)} = \sqrt{1/2 (1 - \cos 15^\circ)} \quad (2).$$

Then follow the rules for finding the sinus of $82^\circ 30'$, 45° , $22^\circ 30'$, $67^\circ 30'$, $11^\circ 15'$, $78^\circ 45'$, $37^\circ 30'$, $52^\circ 30'$.

Using the Hindu *gnomon* of 12 units length but retaining his own radius of 150', he finds the shadow of the sun from its altitude, and conversely, by formulas equivalent to

$$\cot \alpha = \frac{\cos \alpha}{\sin \alpha}, \quad \cos \alpha = \frac{\cot \alpha}{\sqrt{\cot^2 \alpha + 1}}, \quad \sin \alpha = \frac{1}{\sqrt{\cot^2 \alpha + 1}}.$$

As values of π he gives $22/7$, $\sqrt{10}$, $62832/2000$.

The work of JABIR (3), 9 books on astronomy, in the translation of GERARD OF CREMONA was published by PETER APIAN in 1534 (4). Proposition XXIV of the first book follows.

« And since this has already been explained let us begin to show how the unknown sides and angles of a triangle are found from the known, *in order that we may avoid repetitions*. Therefore I say that when in a rectilinear triangle *abg* (fig. 11) two sides *ab*, *bg* and the included angle *b* are known, the side *ag* and the two remaining angles are also known. And this is the proof. I shall draw from point *a* to line *bg* the perpendicular *ad*. Then because angle *abg* and line *bg* are known it is known whether *ad* will fall within or without *bg*. And since *d* is a right angle line *ab* is the diameter of a circle which contains triangle *abd*. Also since angle *b* is known the arc of this circle above *ad* will be known. Therefore the chord *ad* will be known from the measure (quantitatem) by which the diameter of the circle is known. Hence the line *bd* is known. Then since line *bd* is known

(1) This is doubtless closely connected with the Hindu rules for calculating their table of sines and the method of differences employed in these rules. See page 303 above.

(2) « Si autem volueris invenire sinum secundum minores circuli porcionis, sinum huius kardage sexte in sinum 30 graduum multiplica, et collecte inde summe quere radicem, que erit sinus 7 graduum et dimidii. » This, the complete explanation of the above equation, illustrates the absence of proofs in *Canones*.

(3) ABŪ MUḤAMMAD JĀBIR IBN AFLAḤ (GEBER of the Latins) was active in Seville between 1140 and 1150.

(4) *Instrumentum primi mobilis a PETRO APIANO... Accedunt iis Gebri filii Afla Hispalensis... libri IX de astronomia... Norimb. 1534, in folio.*

in relation to lines ab and bd line dg is also known. And since it has already been shown that line ad is known therefore must line ag be known. Therefore by the measure by which side ag is 120 is the perpendicular ad known. Therefore the arc ad in the circle containing triangle adg is known. Hence angle agd is known, and since angle abg was already known angle bag is known. Therefore all the sides and angles of the triangle are known and the proof is complete. »

We observe that JABIR divides the triangle into two right triangles about which he circumscribes circles and finds the unknown parts by the method of chords. The first sentence quoted above shows that he felt the need of an independent trigonometry but the chief value of the work concerns spherical trigonometry and astronomy and therefore need not detain us further.

Turning now to Christian Europe, we find hardly a trace of our science until the twelfth century, about the time Archbishop RAYMOND (between 1130 and 1150) instituted in Toledo a school of translators of Arabic works. From the time of Gerbert (940-1003, in 999 became Pope SYLVESTER II) who probably possessed Arabic works in Latin translation (1) interest in the philosophy of ARISTOTLE and consequently in astronomy and mathematics grew until, with the waning of Moslem power in Spain, the Christians, assisted by Jewish scholars, in the XIIIth century attained an activity in translating Arabic works that rivalled that of the Arabs themselves in their acquisition of the treasures of Greek and Hindu learning. The most prolific of these translators was GERARD OF CREMONA (1114-1187). Among the 76 works that he turned into Latin were PTOLEMY's *Almagest*, the *Canones* of AZ-ZARQALI, the *Spherics* of MENELAUS, and the works of JABIR and THABIT IBN QURRAH. JOHN OF SEVILLE (active 1135-1153), known also as JOHN OF LUNA and as JOHANNES HISPALENSIS, produced a Latin version of AL-FERGANI's (ALFRAGANUS in Latin) astronomy, PLATO of Tivoli (about 1136) translated AL-BATTANI's *De motu stellarum* and the *Spherics* of THEODOSIUS, and ATHELARD OF BATH (between 1120 and 1130), one of the earliest in this field of activity, made accessible to the Latins the astronomical tables of AL-KHUYWANIZMI (2).

(1) DUEM, *Le système du monde*, vol. 3, p. 163-165. Paris, 1915.

(2) See also HASKINS, "The Reception of Arabic Science in England", *The English Historical Review*, Jan. 1915, p. 56-69. Here are discussed the labors of WALCHER, PETRUS ANFUSI, ROBERT OF CHESTER, ROGER OF HEREFORD, DANIEL OF MORLEY, etc.

With the opening of the thirteenth century we observe the transition from mere translation to constructive mathematical production. In the year 1202 LEONARD OF PISA, called also FIBONACCI, published his *Liber Abaci*, of great importance in the history of arithmetic and algebra, and in 1220 his *Practica Geometriae* (1), in which for the first time surveying by trigonometric methods is reduced to a mathematical basis. While earlier works on surveying had been for the most part a collection of rules, LEONARD OF PISA gave derivations and proofs. His knowledge of trigonometry is derived from PTOLEMY but he defines the *sinus rectus* and *sagitta* (*sinus versus*) like the Arabs. His table of chords and arcs is constructed with a diameter of 42 *perticae* and circumference 132 *perticae*, where 1 *pertica* (measuring rod) = 6 *pedum* = 108 *unciarum* = 2160 *punctorum* (2). With his quadrant (3), constructed after the manner of the Arabs, can be read from the position of the plumb-line the *umbra recta* and the *umbra versa* though the term *umbra* does not appear (4). However, in the work of ROBERT THE ENGLISHMAN (about 1231, Montpellier) we find expressed between the two *umbrae* the relation which is equivalent to $\tan \alpha \cot \alpha = 1$.

Apparently the *Toledo Tables* were little known to the Latins until they appeared in the writings of WILLIAM THE ENGLISHMAN (about 1231, Marseilles) (5). We have already referred (p. 313) to the important astronomical compilation of which the *Alfonsine Tables* formed a part. We may add here that LUCAS GAURICUS (1476-1558), an Italian astrologer and a prolific writer, attributes to CAMPANUS OF NOVARA (active about 1260-1280) a true table of tangents for each degree from 0° to 45° . This antedates by about two centuries the *tabula favenda* (see p. 322) of REGIOMONTANUS which, apparently with good reason notwithstanding GAURICUS' statement, has been supposed the earliest constructed in Europe.

An anonymous manuscript bearing close resemblance to the *Quadrupartitum* was published by CURTZE, who shows that the supposed

(1) BONCOMPAGNI, *Scritti di LEONARDO PISANO del Secolo Decimotercio*. Rome, 1862. *Practica Geometriae* is the second volume of the *Scritti*.

(2) *Practica Geometriae*, p. 95.

(3) Same, p. 206.

(4) Compare BRAUNMÜHL, p. 96-98.

(5) DUHEM, vol. 3, p. 315. In the Latin texts WILLIAM is often designated simply as "MARSILIENSIS".

author was only a commentator and that instead of belonging to the fifteenth century as was formerly supposed the manuscript belongs to the thirteenth century (1). It occupies folios 83^a — 103^b of an excellent manuscript of 127 leaves containing 11 other works. We find in it the terms *gardaga* (*kardaga*, p. 313 above), *cada* (*catha*, p. 299 (2), *sinus rectus*, *sinus versus*. The diameter is assumed to be 300 minutes (300 minutorum) for sines and 120 degrees (120 graduum) for chords. There is one numerical and one linear demonstration of a ratio composed of ratios. The figure illustrating the application to the *catha* and labelled *cada coniuncta* corresponds to WALLINGFORD'S *catha disiuncta* and there is no figure given in the second case. The application of PTOLEMY'S Theorem to the case when one side of the quadrilateral is a diameter of the circle and to finding the chord of the sum and of the difference of the arcs of two given chords concludes the part preceding the astronomical section, that is to folio 87^a. The latter part of this treatise contains a section on the *umbra*, a subject not found in the *Quadripartitum*. Now WALLINGFORD devotes two-thirds of the 46 pages of his work to laying the mathematical foundation whereas the other uses only 8 and in these 8 pages no author or theorem is cited. Our conclusion is that the two works can be only indirectly connected through common sources; a single source seems quite improbable.

(1) *Bibliotheca Mathematica*, Third Series, vol. 1, Leipzig, 1900. Under the title: " Urkunde zur Geschichte der Trigonometrie im christlicher Mittel alter ", CURTZE gives the Latin texts of parts of 8 important manuscripts as follows, the fourth being that under consideration above :

1. Aus dem *liber embadorum* des SAVASORDA in der Uebersetzung des PLATO VON TIVOLI, p. 321-337.
2. Aus dem *Scripta MARSILIENSIS super Canones ARZACHELIS*, p. 347-353. (Compare page 312 above.)
3. Aus den *Canones sive regule super tabulas Toletanas* des AL-ZARĀ'LI, p. 337-347.
4. *Anonyme Abhandlung über Trigonometrie aus dem Ende des XIII Jahrhunderts*, p. 353-372.
5. Aus LEO DE BALNEOLIS ISRAHELITA *de sinibus, chordis et arcibus, item instrumento revelatore secretorum* p. 372-380.
6. *Anonyme Abhandlung De tribus notis*, p. 380-390. •
7. Die *Canones Tabularum primi mobilis* des JOHANNES DE LINERHS, p. 390-413.
8. Die *Sinusrechnung* des JOHANNES DE MURIS, p. 413-416.

(2) Both CURTZE and BRAUNMÜHL say that the variation of the consonants indicates Saxon authorship.

To the year 1321 belongs LEO DE BALNEOLIS ISRAHELITA *de sinibus, chordis et arcibus*..., (1) of LEVI BEN GERSON (died 1344, Avignon), known also as LEO DE BALNEOLIS. It contains 9 chapters, of which the second, composed of 5 parts (*dictiones*), is of special interest for the history of trigonometry. The *dictio prima* gives definitions and explanations of degrees, minutes, etc., signs of the zodiac, division of the diameter into 120 degrees (« not equal to the degrees of the circumference »), arc, chord, *sinus*, and *sagitta*. The *dictio secunda* contains the derivation of the relations which we write thus :

$$\begin{aligned}\text{versin } \alpha + \cos \alpha &= 1, \quad \text{versin}(90^\circ + \alpha) = 1 + \sin \alpha, \\ \text{chd}^2(\alpha \pm \beta) &= (\sin \alpha \pm \sin \beta)^2 + (\text{versin } \alpha - \text{versin } \beta)^2;\end{aligned}$$

the relation $\text{chd}^2 \alpha = \text{sagitta} \cdot \text{diameter}$; and the fact that the chord of the half arc is known from the chord of the arc. From these relations LEVI BEN GERSON constructs a table of sines for intervals of $15'$. From the sines of 90° , 60° , 36° are obtained besides the sines of the halves of these angles the sines of 24° , 6° , $8^\circ 15'$ ($6^\circ + 2^\circ 15'$), and finally of $15' + 1/128^\circ$ ($33/128^\circ$) and $15' - 1/64^\circ$ ($15/64^\circ$). Thence is found the *sinus* of $15' = 0^\circ 15' 42'' 28''' 12'''' 27''''$, a value correct to 7 decimal places. Some further calculation concludes *dictio tertia*. In *dictio quarta* is given the *Tabula sinus* and the explanation of its use for finding the *sinus* and the *sagitta* from the arc, and conversely. *Dictio quinta* (2), containing the theory of the solution of triangles, is an important independent contribution by LEVI BEN GERSON. It contains the following propositions :

(I) Given two lines in a right triangle, the remaining parts are known.

(II) Given the three sides of any triangle, all the angles are known.

(III) Given two sides and the angle opposite one of them, the remaining side and angles are known. (Only one solution.)

Corollary A. « In every triangle one side has to another the same ratio that one sinus of the angles subtended by the lines has to the other ».

Corollary B. If the angles and one side of a triangle are known, so are the remaining sides.

(1) See note, p. 317. This work was translated from Hebrew into Latin in 1342, a fact to which we shall later have occasion to refer.

(2) This part is not given in the above citation but was published by CURTZE in *Bibliotheca Mathematica*, 1898, 2nd series, vol. 12, p. 103-106.

(IV) Given two sides and the included angle of a triangle, the remaining parts are known.

Here appears for the first time in the mathematical literature of Europe the clear and definite statement of the sine law. Also the four theorems here presented show great contrast with a similar work on the solution of triangles, *De tribus notis* (1), written about the same year and containing separate treatment of 25 different cases. The method of *De tribus notis* is that of JABIR, that is to divide each triangle into two right triangles and solve by means of the chords and arcs of the circumscribed circles. LEVI BEN GERSON uses the Pythagorean Theorem and the *sinus* in the first case; in the second he determines the height by the Euclidean method and then applies the *sinus*. We give below a rather free translation of his proof of the third case. He uses the same figure in the fourth (2).

In triangle abc (fig. 12) let the lines ab , bc and the angle bac be known. I say that the line ac and the remaining angles are known. To prove this let a circle be passed through the vertices of abc and let ad be the diameter of this circle. Because angle bac is known and inscribed in the circle of which 360 degrees subtends two right angles therefore bc will be known and from the tables of arcs and sines we shall know the chord bc in terms of the 120 degrees of ad . So we know the ratio of cb to ad . Then from the known ratio of bc to ab is known the ratio of ab to ad . Then we know the value of ab in degrees (diametral) and from the tables we shall thus know arc abc . Therefore we know arc ac , the difference of the known arcs. Hence from the tables we know angle abc . Finally from the two known angles we know the third angle. Therefore etc.

The *Canones tabularum primi mobilis* (3) of JOHANNES DE LINERIIS, without mentioning any source, employs verbatim the method of calculating the *sinus* found in the *Canones* of AZ-ZARQALI. Among the tables are *tabule sinuum et cordarum*, *tabula umbre*, and *tabula proportionis*. JOHN OF MEURS, in the last of the CURTZE group of manuscripts, shows some independence by constructing a figure of his own to replace that handed down from AZ-ZARQALI. The *Practica geometriæ* shows that its author DOMINICUS DE CLAVASIO (active 1349-1357, Paris) was acquainted with *sinus*, *sinus versus*, *complementum*

(1) See note page 317.

(2) Compare BRAUNMÜHL, p. 103-106.

(3) Written in Paris, 1322. See note, p. 317.

sinus versus, *umbra recta*, *umbra versa* and well versed in EUCLID, PTOLEMY and WITELLO. Moreover he gave strict proofs for the rules he set up for surveying (1).

JOHANN SCHINDEL (1380?-1442), known also as JOHANNES DE GEMUNDEN, wrote JOHANNES DE GEMUNDEN *de sinibus, chordis et arcibus* in which appear the terms *sinus rectus*, *sinus versus* and *sagitta*, *sinus totus* or *perfectus*, *cardaga*. As in our tables he uses proportional parts and gives the differences. With him originates the radius of 600 000 though the idea of combining decimal and sexagesimal measurement may have been due to JOHANNES DE LINERHS. It remained for GEORG PEURBACH (1423-1461, Vienna) to construct a complete table of sines for intervals of 10' with the above radius (2). It is interesting to note that PEURBACH was the first to employ the «geometric square» for astronomical as well as for terrestrial measurements (3). Instead of the usual 12 units for the length of BC (fig. 13) he uses 1200. He finds

$$\sin \alpha = \left[\frac{a}{\sqrt{a^2 + 1200^2}} \right] \cdot 600000$$

where $a = BP$. So we really have a table of arctangents, since $\alpha = \arctan a/1200$.

JOHANNES MÜLLER (1436-1476), generally known as REGIOMONTANUS from the Latin name of his birth place, Königsberg, became at the age of 15 years a pupil of PEURBACH. In intimate association and collaboration with his teacher during the last ten years of PEURBACH's life REGIOMONTANUS gained the necessary inspiration and equipment for the great labors that lay before him. In his extensive travels he made the acquaintance of the Italian astronomers as well as those of his own country. He was well versed in Greek and Latin and as early as 1464 he lectured on the Arabic astronomer AL-FERGANI. Indeed it was from Arabic sources that he drew most of his

(1) CURTZE, « Ueber den DOMINICUS PARISIENSIS der *Geometria Culmensis* », *Bibliotheca Mathematica*, 1895, p. 107-110. CURTZE says: « The *Practica Geometriae* reveals DOMINICUS as an able mathematician who for his time developed noteworthy accomplishments ».

(2) This table was not published because the more accurate table of REGIOMONTANUS appeared before PEURBACH's *Tractatus* went to press. (BRAUNMÜHL, p. 116.)

(3) CURTZE, « Ueber die Mittelalter zur Feldmessung benutzen Instrumenten », *Bibliotheca Math.*, 1896, p. 65-72.

knowledge of trigonometry (1). His short but very active career came to an end in 1476 while he was in Rome to reform the calendar for Pope Sixtus IV.

We have already mentioned his construction of trigonometric tables (p. 304). To his *Tabulae directionum* (2) is appended a table of sines to radius 60 000 for intervals of one minute. This we may consider as the forerunner of the popular 5-place tables of the nineteenth century. With the *Tractatus GEORGI PORBACHII super propositiones PTOLEMEI de sinibus et chordis* which contains the familiar figure of AZ-ZARQALI and 6 propositions for finding the chord of any arc is commonly bound REGIOMONTANUS' *Compositio tabularum sinuum*. This work also contains 6 propositions: (I) Given the sinus of an arc, to find the sinus of its complement. (II) To find the sinus of arcs by kardagas. (III) The sinus of an arc ($< 90^\circ$) is the mean proportional between $r/2$ and the sinus versus of twice the arc. (IV) To find the side of regular pentagon and decagon. This is followed by a table, for $r = 600\,000\,000$, of the 96 values of the sine that can be readily obtained by applying the preceding propositions. (V) To find the side of the quindecagon. (VI) Ordinates of equal arcs are farther apart toward the center of the circle. Then comes the table of sines for $r = 6\,000\,000$ followed by the table for $r = 10\,000\,000$, the interval in each case being one minute.

The first systematic treatise on trigonometry published in Europe is JOHANNES DE MONTEREGIO *de triangulis omnimodis libri quinque* (3). Of the five books the first two deal with plane and the last three with spherical triangles. Of the 57 propositions of book I the first 49 treat of proportion and the rest deal geometrically with the finding of unknown parts in right, isosceles, and scalene triangles. Following each proposition is an explanation of its use and often a numerical illustration is also given. Only in proposition 20 is there mention of a trigonometric function: « In any right triangle, if you describe from one acute angle a circle with the greatest side as radius the side

1) BRAUNMÜHL concludes after careful examination of the matter that his sources were the works of AL-BATTANI, AL-FERGANI, AZ-ZARQALI and JABIR. (- NASSIR EDDIN TUSI und REGIOMONTAN », p. 38).

(2) Written about 1467 and published in 1490 by RATDOLT in Augsburg.

(3) Written about 1464 and published in Nuremberg in 1533. The *Compositio* was published there in 1541. The three works are in the University of Michigan library.

opposite this angle will be the sinus rectus of its arc; but the third side will be the sinus rectus of the complementary arc. » The first of the 33 propositions of book II is the sine law. The one figure and the proof resemble Ar-Tusi's given above (p. 312) but it has not been proved that the *Treatise on the Quadrilateral* was known to REGIOMONTANUS. The statement and proof of proposition 25 follow.

« If in any triangle we know the base, the opposite angle and the perpendicular (altitude) or the area we shall at once know each of the sides. In the triangle abg (fig. 14) let the base bg , the perpendicular ad , or the area since the one depends on the other, and the angle bag be known. I say that we can know each of the sides. For let angle bag be obtuse and let the perpendicular from b meet ga produced at k . Then since angle bak is known the ratio of ab to bk is known by (blank) of this (book). But this ratio equals the ratio of ab times ag to bk times ag . Then since bk times ag is twice the area of triangle abg it is known and therefore the rectangle (product) of ab and ag is known. Now by the preceding proposition the diameter of the circumscribed circle is known from the perpendicular ad and the rectangle of ab and ag . Let the diameter pq meet the chord bg in m and let the radii eg , ea be drawn, as also el parallel to bg and meeting ad produced in n . Then dn equals em which is known from eg , mg and right angle emg . Hence an is known. Then ne is known from an , ae and right angle ane . Thus is known its equal dm and consequently the smaller segment bd which is the difference between bm and dm and the larger segment dg which is their sum are known. From these two segments and the perpendicular ad will be known the two sides » (1).

It is evident that REGIOMONTANUS was interested in a unified basis and systematic arrangement of trigonometric theory with the object of making it useful to the astronomer. That he early saw the advantage of the tangent function is evidenced by the appearance in his *Tabulae directionum* of a table of tangents for every degree from 0° to 90° with $r = 100\,000$. He called it the *tabula fecunda*, that is

(1) We can find ab and ag from the two equations $bg^2 = ab^2 + ag^2 - 2 \cdot ab \cdot ag \cdot \cos bag$, $ab \cdot ag \cdot \sin bag = ad \cdot bg$. The first implicit statement of the formula for the area of a triangle in terms of two sides and the sine of the included angle appears to be proposition 26: « The area of a triangle and the product of two sides being known, either the included angle or its supplement will emerge ».

the *fruitful* (and therefore very useful) *table*, and the name was afterwards generally adopted to distinguish this table from the *tabulæ umbrarum*. The influence of REGIOMONTANUS' work on the progress of science was very great; his *De triangulis* ushered in a new era in the development of trigonometry.

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Notes and correspondence.

The most important thing in the world. -- From my point of view there are two things of immense importance in this world, two ideas or beliefs upon which, in the last analysis, the weal or woe of the race depends, and I am not going to say that belief in the possibilities of scientific progress is the most important. *The most important thing in the world is a belief in the reality of moral and spiritual values.* It was because we lost that belief that the world war came, and if we do not now find a way to regain and to strengthen that belief, then science is of no value. But, on the other hand, it is also true that even with that belief there is little hope of progress except through its twin sister, only second in importance, namely, belief in the spirit and the method of GALILEO, of NEWTON, of FARADAY, and of the other great builders of this modern scientific age, this age of the understanding and the control of nature, upon which let us hope we are just entering. For while a starving man may indeed be supremely happy, it is certain that he can not be happy very long. So long as man is a physical being, his spiritual and his physical well-being can not be disentangled. No efforts toward social readjustments or toward the redistribution of wealth have one thousandth as large a chance of contributing to human well-being as have the efforts of the physicist, the chemist, and the biologist toward the better understanding and the better control of nature. (1).

(UNIVERSITY OF CHICAGO.)

R. A. MILLIKAN.

Classiques de la Science. — A plusieurs reprises (*Isis*, I, 99, 246, 476, 706; II, 125-161, 168-170), G. SARTON a parlé ici des collections des classiques de la science. Les lecteurs de langue française n'ont eu longtemps à leur disposition que les recueils de mémoires originaux, souvent difficiles à consulter, et non traduits. Enfin avait commencé à paraître, en 1913, à la librairie AD. COLIN, une collection des *Classiques de la science* (*Isis*, I, 706), dont les volumes se succèdent avec une lenteur désespérante : sept seulement ont vu le jour jusqu'à présent, dont les quatre premiers en 1913.

MAURICE SOLOVINE a commencé à faire paraître, en 1920, à la librairie

(1) From the address delivered by R. A. MILLIKAN at the National Museum, Washington D. C. on May 25, 1921, in connection with the presentation of a gram of radium to Mad. CURIE, as printed in *Science*, vol. 54, p. 1-8, July, 1921.

GAUTHIER-VILLARS & C^{ie}, une collection des *Maîtres de la pensée scientifique* qui comprendra les mémoires et les ouvrages les plus importants de tous les temps et de tous les pays, et dans laquelle tous les domaines de la science seront représentés. Ont déjà été publiés, en petits volumes (180 × 115). HUYGENS : *Traité de la lumière* ; LAVOISIER : *Mémoires sur la respiration et la transpiration des animaux* ; SPALLANZANI : *Observations et expériences faites sur les animalcules des infusions* ; CLAIRAUT : *Eléments de géométrie* ; LAVOISIER ET LAPLACE : *Mémoire sur la chaleur* ; CARNOT : *Réflexions sur la métaphysique du calcul infinitésimal* ; D'ALEMBERT : *Traité de Dynamique* ; DUTROCHET : *Les mouvements des végétaux ; du réveil et du sommeil des plantes*.

Chacun de ces volumes comporte une notice biographique, un peu trop brève, à mon avis.

Sont annoncés des mémoires d'AMPÈRE, LAPLACE, GALILÉE, HERTZ, MARIOTTE, etc.

L. GUINET.

Collection des Mises au point. — Après les bouleversements causés par la guerre dans presque toutes les branches de la connaissance, un instant de recueillement est nécessaire si nous voulons arriver à saisir à quel point nous en sommes, quels sont les résultats acquis, tant au point de vue de la science pure que de la science appliquée.

Partant de cette idée, la librairie GAUTHIER-VILLARS & C^{ie} entreprend la publication d'une *Collection des Mises au point*, placée sous le patronage de l'industrie, et dans laquelle chacun des livres — il y en aura une vingtaine — rédigé par un spécialiste, répond à ces questions pour une science déterminée.

Chaque volume comprendra, d'après la notice de l'éditeur : 1° Un rappel des principes essentiels (anciens et nouveaux) ; 2° Un tableau assez détaillé de chaque science, l'historique de la science étudiée, l'enchaînement des méthodes, l'évolution des doctrines et des idées, et les perfectionnements des méthodes ; 3° Des conclusions générales sur l'extension de la science envisagée, les possibilités d'évolution des théories et principes, les principaux problèmes qui restent à résoudre et les perfectionnements à réaliser. Pour que ces mises au point restent ce qu'elles veulent être, des rééditions de chaque volume seront tenues à jour.

J'ai sous les yeux un volume de cette collection, dû à L. DE LAUNAY, *Où en est la géologie*. Il est digne du but que se sont proposé les éditeurs ; il y manque cependant un index sommaire des principaux ouvrages et périodiques relatifs à la Géologie.

Ont également paru un volume traitant de la météorologie, de A. BERGET, et un autre pour l'astronomie, de l'abbé TH. MOREUX.

L. GUINET.

Reviews

Packard, Francis R. — *Life and times of AMBROISE PARÉ (1510-1590).*

With a new translation of his Apology and an Account of his Journeys in Divers Places, XII + 297 p., illustrated. New York. PAUL B. HOEBER, 1921. [§ 7 50]

The distinguished editor of the *Annals of Medical History* is offering us a new account of the life of AMBROISE PARÉ. He does not claim to have discovered any additional information but simply to tell afresh the facts which have been brought to light by MALGAIGNE (1840-1841) and LE PAULMIER (1884) and told in English by STEPHEN PAGET (1897). Dr PACKARD's account is clear and entertaining; the facts of PARÉ's life and his literary productions are introduced in one single chronological sequence. Then follows the translation of the racy autobiographical fragments which PARÉ published in 1585, in the fourth French edition of his collected works.

The moot question, whether PARÉ was a Huguenot or not, is discussed in a very judicial manner. In a memoir written by PARÉ in 1575 (and published by LE PAULMIER) he stated himself that he belonged to « the Religion », but he was at any rate a very lukewarm Huguenot, who had many powerful friends at the Catholic court and was spared at the massacre of St. BARTHOLOMEW. As all that we know of him makes him appear a very pious and honest man, we must conclude that PARÉ was like MONTAIGNE, RABELAIS and ERASMUS « au-dessus de la mêlée ». Possibly also his scientific curiosity and his professional duties engrossed him so much that there was no place left in his heart for religious fanaticism of any kind.

The book is splendidly got up. As a matter of fact I doubt whether such an expensive publication was entirely justified. It seems to me a little extravagant. There are many beautiful illustrations; but some are not strictly relevant (the two folded maps of Paris, for instance). I have noticed a number of misprints in the French and Italian phrases. Maybe some are sixteenth century misprints, but then the editor should have guarded himself by adding the word *sic*.

Such misprints (in the matter of accents, for example) are always irritating, but never more than in an edition de luxe : they look then like greasy spots on a wedding gown.

G. S.

Louis Dimier. — BUFFON, 308 p Paris, Nouvelle librairie nationale, 1919.

Ce livre contient la matière des leçons données par l'auteur en 1918 à l'Institut d'Action Française à Paris. M. LOUIS DIMIER s'était donné pour tâche de réhabiliter BUFFON et cela est fort bien, car ce grand homme est injustement discrédité de nos jours. Mais il était possible de le réhabiliter sans insulter les Encyclopédistes. Détruire une injustice est une œuvre louable, mais remplacer une injustice par une autre, à quoi bon ? — Quoi qu'il en soit, en dépit de son parti pris cléricale, ce livre est fort intéressant et se lit avec plaisir. Et j'ajouterai qu'il y a toujours du profit à lire des ouvrages dominés par des préjugés hostiles à ceux qu'on nourrit soi-même. — BUFFON était décidément un homme de l'ancien régime ; il n'en avait pas les vices, mais il en avait toutes les qualités et les élégances ; il était généreux et bon et l'on ne peut refuser son admiration à l'auteur de l'*Histoire naturelle*, un des plus grands monuments du XVIII^e siècle. Le livre de M. DIMIER est fort bien informé et nous raconte agréablement comment l'*Histoire naturelle* fut lentement édifiée par BUFFON et ses nombreux collaborateurs, savants et artistes. Par exemple, plus de quatre-vingts artistes furent employés continuellement pour les planches en couleurs. Il nous fait voir aussi la grande œuvre administrative de BUFFON, qui fut le vrai créateur du Museum. A ce propos il nous donne des renseignements fort intéressants sur les collections d'histoire naturelle existant à Paris. En 1787, il n'y en avait pas moins de quarante-cinq. L'auteur en conclut que la diffusion de la science était poussée plus loin au XVIII^e siècle que de nos jours : c'est là une conclusion bien hasardeuse. Il ajoute un peu plus loin (p. 181) : « Si le XVIII^e siècle fut le siècle de la science, il faut avouer que le XIX^e aura été celui de la pédanterie, etc ... » Il y a du vrai dans ces diatribes, mais elles n'en sont pas moins sectaires et injustes.

Les relations de BUFFON avec les Encyclopédistes donnent à M. DIMIER une excellente occasion de médire de ceux-ci. Encore une fois certains de ses reproches ne sont que trop fondés. Lorsqu'il signale les plagiais de l'Encyclopédie, par exemple, il fait chose utile. Il est certain que BUFFON n'aimait point les philosophes ; il fréquentait le salon de M^{me} NECKER, et NECKER, adversaire de TURGOR, était leur ennemi. Cependant, BUFFON donna l'article « Nature » à l'Encyclopédie. M. DIMIER a un peu plus d'indulgence pour VOLTAIRE, et je veux citer

le passage suivant (p. 226), qui donnera une idée de sa manière : « Si parmi tant de négations détestables, il y eut chez VOLTAIRE un mérite, c'aura été la persévérance. l'éloquence. les ressources d'invective et de satire avec lesquelles il combattit la bestialité de ROUSSEAU. Au milieu d'erreurs et de méchancetés sans nombre, VOLTAIRE fut un civilisé; ROUSSEAU fut un sauvage. DIDEROT et ses pareils, contemplés de ce point de vue, apparaissent comme civilisés à peine, par l'idée ravalée qu'ils se faisaient de l'esprit, aussi bien que de l'effort humain: tout leur éloge des arts n'aboutissant qu'à l'apothéose des inventions ».

BUFFON était un grand seigneur, mais si le portrait de M. DIMIER est fidèle, c'était un homme aimable autant que grand. Il mourut en 1788 à la veille de la révolution, mais celle-ci causa la ruine de sa famille et son fils unique périt sur l'échafaud. On conçoit que M. DIMIER ait écrit avec joie un éloge qui lui permit de montrer l'ancien régime sous son aspect le plus séduisant. Comme il défend une cause perdue — car l'humanité ne revient jamais sur ses pas, — je lui pardonne volontiers son intolérance.

GEORGE SARTON.

W. A. Osborne. — WILLIAM SUTHERLAND. A biography, 102 p. Melbourne, The Lothian book publishing Co., 1920.

Dr. W. A. OSBORNE, professor of physiology at the University of Melbourne, has written this biography *con amore*, and it is doubly precious to us for it retraces the life of one who was at once a noble man and one of the first Australian scientists.

WILLIAM OSBORNE was born in Dumbarton, Scotland, on August 4, 1859. Both his parents were Scots; they were poor but gentle. The father was a woodcarver, and his specialty was the carving of figureheads for ships. They migrated to Australia in 1864, having at that time six children. They first went to Sydney, but in 1870 they moved to Melbourne where they finally settled down. WILLIAM gave signs promptly of his higher intellectual abilities and was educated at Wesley College, later at Melbourne University (which was, in 1876, only twenty years old, a very small institution indeed, counting only 130 students, all boys). In 1880 he won the GILCHRIST scholarship for study in England. He arrived in London in the previous September, and it seems that his trip from Australia to the old world was his first contact with the uglier and ruder side of life, so well had he been thus far protected by the refined atmosphere of his home and of his university environment. He matriculated at University College, London, sat at the feet of RAY LANKESTER and CAREY FOSTER and won first class honours in experimental physics in 1881. On the whole his stay in England rather disappointed him, — he had become an Australian to the core — and

after five weeks of travel in France, Germany and Italy, he hastened to return to his beloved country.

His first scientific paper on «the mechanical integration of the product of two functions» was published in the *Philosophical Magazine* of August 1885; but his first paper of real importance appeared only a year later in the same journal. It deals with «the law of attraction amongst the molecules of gas». He thus revealed from the beginning his bent towards molecular physics, to the study of which his whole life was to be devoted. In this paper SUTHERLAND showed that the molecules of a gas attract one another with a force inversely proportional to the fourth power of the distance between them, — a law which he applied later in 1893, to discover the true relation between viscosity and temperature. As this discovery will probably immortalize his name more than any other, it is well to explain it briefly. CLERK MAXWELL had stated in 1860 that, if the kinetic theory of gases was correct, the viscosity ought to be independent of the pressure. Experiments confirmed this. But MAXWELL had also stated that the viscosity should vary as the square root of the absolute temperature, and this was experimentally disproved. SUTHERLAND showed that the true relation was the one summarized in the formula:

$$\eta_t = \eta_0 \frac{273 + C}{\theta + C} \left(\frac{\theta}{273} \right)^2$$

wherein θ is the absolute temperature and C a constant (SUTHERLAND's constant). I can not describe SUTHERLAND's other investigations on such subjects as the nature of emulsion, the application of electrochemical ideas to the properties of matter, the molecular structure of water, etc. The reader will find a brief but sufficient treatment of these questions in OSBORNE's book. He will find in it also a list of SUTHERLAND's sixty-nine scientific papers with the corrections found in the author's own copies of them. Suffice it to say that most of them deal with molecular physics, and are chiefly theoretical, though SUTHERLAND took into account every available experimental datum. He himself did not conduct experiments, beyond a few very simple ones. It is probable that even if he had been able to avail himself of a well equipped laboratory, he would not have become a remarkable experimenter, for it is clear that he was not a born experimenter; he was essentially of a meditative nature.

This also explains why he could never be persuaded to accept a regular position. He was anxious to remain entirely free to follow his intellectual dream without restrictions of any kind. No amount of money could have compensated him for this loss of freedom. Hence he

did only such work as was necessary to provide for his very simple needs; he did some coaching and examining and wrote weekly articles for the Melbourne press. These articles were devoted either to popular explanations of the scientific problems of the day or to the disinterested discussion of current events. At a time when most men, small or big, poor or rich, seem always ready to prostitute themselves for a little more money, and have no time left for the only things which make life worth living, it is truly refreshing to meet a man like OSBORNE. « Sometimes — wrote he in 1886 — I regard myself as a very enviable creature, earning little enough it is true, but with no outside worries or duties — working away in the quiet house — working to a continual accompaniment of CHOPIN, SCHUBERT and BEETHOVEN. » Music was his main recreation and occasionally short walking trips in the Australian bush. SUTHERLAND was a man according to my own heart. It is a pity, however, that he did not marry. As he lived with his brothers and sisters and had no establishment of his own, his material life was considerably simplified. But an unmarried philosopher can not be a complete philosopher. It is only when a man has to strive toward a high ideal and at the same time provide for the comfort and happiness of wife and children that the struggle becomes truly heroic and that we can judge him at his best.

WILLIAM SUTHERLAND died on October 5, 1911. We may properly conclude this review with the last words of his biographer: « Science, we all know, has had her martyrs. What we should realize with equal conviction, is that she has had her saints. And amongst the saints of science high place will assuredly be found for WILLIAM SUTHERLAND. »

GEORGE SARTON.

Was wir Ernst Haeckel verdanken. Ein Buch der Verehrung und Dankbarkeit. Im Auftrag des Deutschen Monistenbundes herausgegeben von HEINRICH SCHMIDT. Mit 12 Abbildungen, darunter 5 HAECKEL-Porträts. 2 Bände, 432 und 416 Seiten, Weltformat IX. Leipzig. 1914, Verlag UNESMA.

Zur rechten Zeit ist dieses Buch erschienen, knapp vor Ausbruch des Krieges, der mit seinen Folgeerscheinungen die klare Atmosphäre wissenschaftlichen Urteils über Männer wie HAECKEL so sehr getrübt hat. Auch haben es die Nachkriegsverhältnisse mit sich gebracht, dass anlässlich des Todes des grossen Gelehrten (9. August 1919) weit weniger Urteile über ihn veröffentlicht wurden als bei früheren Anlässen, z. B. seinem achtzigsten Geburtstage, dem auch die vorliegende Festschrift galt. Sie orientiert reichlich, wenn auch nicht erschöpfend, von der einen Seite her — derjenigen seiner Freunde und Anhänger —

über des Gelehrten Lebenswerk. 123 Männer und Frauen aller Berufe, auch zahlreiche Ausländer, sprechen aus, welchen Gewinn ihnen und anderen HAECKELS Wirken gebracht habe, und man erhält ein glaubhaftes Bild von der grossen, geistigen Bewegung, welche durch ihn hervorgerufen beziehungsweise gesteigert wurde.

Als Einleitung schrieb der HAECKEL-Schüler H. SCHMIDT (Jena) eine interessante Abhandlung: sie stellt zunächst das Lebenswerk HAECKELS in den grossen Zusammenhang der kulturellen und geistigen Strömungen der Neuzeit und berichtet sodann nach sachlichen Gesichtspunkten über des Gelehrten Leben und Arbeit. Wieder wird seine ungeheure Arbeitsleistung auf systematisch-zoologischem Gebiete sowohl wie insbesondere für den Ausbau und die Anwendung der DARWINSchen Lehre aufgerollt; eine Leistung, die sich zu DARWINS Grundsätzen so verhält wie das Arbeitsprodukt zum Werkzeug. Denn der englische Gelehrte hatte *induktiv* gearbeitet und jene Forschungsgrundsätze geschaffen, die — nicht bloss bei HAECKEL und nicht bloss in der Biologie im engeren Sinne — ihre epochalen Wirkungen entfalten sollten. HAECKELS Stärke war die Deduktion und Synthese, gepaart allerdings mit schärfstem Blick für Tierformen und ihre Beziehungen, sowie mit einer seltenen Arbeitskraft. Sein künstlerischer Trieb nach Vollständigkeit der Lehre und des ganzen Weltbildes fand in DARWINS Ideen das geeignete Instrument; einmal (1860) erfasst, wirkten diese als Auslösung der einzigartigen Energie des 26jährigen Mediziners und inspirierten ihn zur Berufswahl und ganzen Arbeitsrichtung — durch ihn hunderte von Forschern, die unter seinen Einfluss traten und hunderttausende von Menschen, die er für den Darwinschen-Ideenkreis gewinnen sollte. Was der Wiener Zoologe B. HATSCHKE (II, 236) über ihn sagt: dass die meisten lebenden Zoologen als seine mittelbaren Schüler betrachtet werden könnten, ist für das deutsche Sprachgebiet sicherlich richtig; und dasselbe gilt von dem Ausspruch BAEGES (II, 153) die grosszügige freigeistig-kulturelle Bewegung Deutschlands in den letzten Jahren (vor dem Kriege) wäre ohne HAECKEL nicht möglich gewesen. — Die Gegenströmungen hat SCHMIDT nur insoweit berücksichtigt, als sie dem jungen HAECKEL galten, der sie so schneidig abwehrte; die scharfen Entgegnungen auf seine naturphilosophischen Schriften, insbesondere die verbreitetste von ihnen, *Die Weltrütsel*, sind kaum gestreift, die heftigen persönlichen Angriffe gegen den greisen Forscher übergangen — obwohl letztere nicht gegen HAECKEL, sondern nur gegen seine Feinde sprechen. Vielleicht wäre es auch von einer ernsten wissenschaftlichen Darstellung nicht zuviel gefordert, die Irrtümer HAECKELS und seiner Freunde z. B. die Bathybius-Angelegenheit, zu erwähnen; das Gesamtbild hätte dadurch gewonnen.

Im Hauptteile folgen die Antworten der befragten Personen im ganzen

zufällig (in der Reihenfolge ihres Einlangens) aufeinander; man muss die Stimmen sichten, um einen reinen Eindruck zu erhalten. Im Vordergrund steht begreiflicherweise die *Persönlichkeit* des Gelehrten. Den Auftakt gibt WILHELM OSTWALD, dessen Initiative das Buch zu verdanken ist. Er schildert HAECKEL als einen Mann "von einer geradezu rührenden Bescheidenheit und Bereitwilligkeit, sich beeinflussen zu lassen und seine Meinungen zu prüfen. . . . Die Art, wie er sich z. B. zu den wohlbekannten groben und über die sachliche Gegnerschaft weit hinausgehenden Angriffe CHWOLSONS äusserte, entsprach so sehr dem von dem Stifter des Christentums aufgestellten Ideal der persönlichen Milde auch den Feinden gegenüber, wie ich sie bei meiner mannigfaltigen Kenntnis von Geistlichen, theologischen Professoren, Priestern usw. niemals vorher bei den Dienern am Worte Gottes angetroffen hatte. Dieser unversöhnliche Gegner alles dogmatischen Christentums erwies sich als der beste und vorgeschrittenste „Christ“, den ich je persönlich kennen gelernt hatte“. In gleicher Weise findet sich der wissenschaftliche Gegner (SCHAXEL) nach dem Eindruck der Kämpfernatur, die aus HAECKELS Reden und Schriften spricht, von dessen persönlichem Wesen überrascht: „Bei grosser Bestimmtheit im eigentlichen Vortrag und im geschriebenen Wort oder gar in der öffentlichen Polemik zeigt er sich in der privaten Diskussion von einer überraschenden Bescheidenheit, von einer Zugänglichkeit für alle Einwendungen, die niemand erwartet, der ihn nur als Redner und Schriftsteller kennt.“ Wahrlich Beiträge zur Wesensschilderung des *modernen* Dogmatikers! Ein anderer wissenschaftlicher Gegner (BRUNNER) führt die Anerkennung, welche er trotzdem bei HAECKEL fand, auf dessen „grundgütiges“ Menschentum zurück. Und immer wieder kehrt das Lob des „prächtigen, natürlichen, liebevollen Menschen“ HAECKEL (WALTHER MAY).

Ueber HAECKEL als *Fachmann* spricht wieder OSTWALD das Leitmotiv: „Ich fand in ihm einen der reinsten und gleichzeitig edelsten Repräsentanten des romantischen Typus der Forscher“. Für die Merkmale eines Romantikers, wie sie OSTWALD in dem Werke *Grosse Männer* aufgestellt hat, finden sich bei HAECKEL in der Tat stets neue Belege. Die grosse Geschwindigkeit der psychischen Reaktion wird aus mitgeteilten Gesprächen und Gelegenheitsreden deutlich. Die leidenschaftliche Begeisterung für das eigene Fach und die Gabe, sie anderen mitzuteilen, erhellt aus den Aussagen der durch HAECKEL persönlich dafür Gewonnenen (R. KELLER, RICH. HERTWIG, LEON u. a.). Der Romantiker ist ein guter, überzeugender und weite Wirkungen übender Lehrer — die fesselnden Schilderungen des Milieus an HAECKELS Lehrkanzel durch ANTIPA, LEEGE, SCHAXEL, VERWORN (weniger günstig: REH) erinnern deutlich an das Wirken eines anderen Romantikers, von dem

ein halbes Jahrhundert früher der Aufschwung der deutschen chemischen Forschung ausging, an LIEBIG. Wie LIEBIGs Schüler besetzen auch diejenigen HAECKELS eine grosse Zahl von Lehrstühlen im eigenen und Auslande und gründen so neue Zentren seines Einflusses; von ihnen kommen zu Worte RABL-Leipzig, (OSK. HERTWIG-Berlin), RICH. HERTWIG-München, FUEBRINGER-Heidelberg, LEON JASSY, ORTMANN-Pittsburgh. — Der Romantiker ist ein fruchtbarer Schriftsteller, streut reiche Anregungen aus und geht in seinem Eifer gelegentlich über das hinaus, was sich streng erhalten lässt: vielleicht war dieser Charakter unentbehrlich für die Aufstellung solcher Hypothesengebäude wie es HAECKELS Stammbäume waren; enthält doch sein Werk *Systematische Phylogenie* nach A. LANG (I. 135) über 600 solcher Hypothesen. HAECKEL war überzeugt, damit eine notwendige und erspriessliche Arbeit zu leisten und seiner Meinung war auch HUXLEY, welcher schon 1869 über die *Natürliche Schöpfungsgeschichte* schrieb: „Mag man nun mit HAECKEL übereinstimmen oder nicht, so fühlt man doch, dass er das Denken in Bahnen gezwungen hat, in denen irrezugehen vorteilhafter ist als stillezustehen“ (I, 103). — Mehrere Aeusserungen vervollständigen das Charakterbild des Forschers: seine „ausserordentliche Synthetisierungskraft“ (ANTIPA), das epochal wirkende Zurückdrängen der Detailfragen gegen die grossen, vom Darwinismus aufgeworfenen Grundfragen (R. HERTWIG), das grosse künstlerische Verständnis (Maler KOERNER), die Auswertung der Reisen, die ihm GOETHE und HUMBOLDT zur Seite stellt (WALTHER); u. dgl. m.

Der *Philosoph* HAECKEL und sein einschlägiges Hauptwerk *Die Weltrütsel* (1899) begegnen auch hier verschiedener Beurteilung, wenngleich die unbedingten Anhänger überwiegen. Die Akademiker enthalten sich zumeist der Aussage, doch zeugen gelegentliche Bemerkungen einiger von ihrer ablehnenden Stellung; so sagt HATSCHKE bei aller begeisterten Anerkennung des Zoologen HAECKEL, dieser folge seinem ursprünglichen Hange zur Naturphilosophie vielleicht allzusehr; für W. MAY waren die *Weltrütsel* geradezu Anlass zur Wiederabkehr von der Weltanschauung, die er aus der *Natürlichen Schöpfungsgeschichte* aufgenommen hatte. R. GOLDSCHMID berichtet von den scharf verurteilenden Worten des bekannten Philosophen PAULSEN und behauptet aus authentischer Quelle zu wissen, er habe sie später bereut. — Aus den meisten Urteilen spricht eine überströmende Dankbarkeit für die Befreiung vom Druck des Aberglaubens und die Einführung in die reiche Welt der Naturwissenschaft. Typisch ist z. B. der Ausspruch von Dr. HUSCHKE: „Man mag gegen dieses vielbefehdete und verketzerte Buch vorbringen, was man will . . . für mich ist es im höchsten Grade segensreich gewesen“. In der Tat: der naturwissenschaftlich-gerichtete Kritiker mag den *naiven Realismus* HAECKELS als Philosophie ab-

lehnen — er wird ihm darum doch die grosse aufklärende Wirkung, die Beiseiteräumung sovielen mittelalterlichen Schuttes danken und die neue Welle der Begeisterung für die Wunder der Naturwissenschaft, im besonderen die erfolgreiche Bekämpfung der Indolenz gegenüber der Entwicklungslehre (RABL) als Kulturtaten grössten Stiles begrüessen. Mehrere Mitarbeiter wurden durch HAECKEL von unerträglichem Druck der Höllen- und Gespensterfurcht befreit — der Ausdruck „mein Erlöser“ für den Gelehrten kehrt mehrmals wieder; ebenso sind die Bemerkungen typisch: „er hat meinem Leben Zweck und Inhalt gegeben“ (SCHNEIDER, Bankbeamter); das Buch bedeutet „meine eigentliche Menschwerdung“ (RIESS, Kaufmann); „dieser Lichtschimmer durch die Aufklärung war ein Wendepunkt in meinem Leben“ (DOPF, Arbeiter); usw. *Die Welträtsel* waren bis 1913 in 310 000 deutschen Exemplaren verbreitet; aus dem englischen Sprachgebiet berichtet McCABE (London), dass mehr als 250 000 Stück der Uebersetzung gekauft wurden.

Die grossen Kulturnationen sind sämtlich mit anerkennenden Aeusserungen über HAECKELS Lebenswerk vertreten; die Franzosen allerdings nur durch den französischen Schweizer Professor YUNG und durch den Brüsseler Prof. JOUSSET DE BELLESME. Der erstere berichtet über die starke Beeinflussung seiner jugendlichen Landsleute durch HAECKELS Bücher; der zweite schildert die Hindernisse, welche in Paris bis 1892 dem Entwicklungsgedanken bereitet wurden. Wenn er den geringen Einfluss HAECKELS in Frankreich auf das Joch eines alten theokratischen Atavismus zurückführt, von dem sich das Land trotz der Anstrengungen nicht befreien könne, so scheint dem doch einiges zu widersprechen und die Aeusserung bedürfte näherer Aufklärung.

Viele Beiträge bringen *autobiographisch Wertvolles*. WALTHER MAY schildert sein wechselvolles Leben, der Anatom FUEBRINGER seine unter HAECKELS Zeichen stehende Laufbahn; R. HERTWIG berichtet, wie er und sein Bruder OSKAR, ursprünglich zu Chemikern bestimmt, durch HAECKELS Persönlichkeit für die Zoologie gewonnen wurden; ähnlich der russische Musiker DAVIDOFF.

Endlich lernt man aus dem Buche auch den *Deutschnationalen* HAECKEL kennen, welcher am Geburtstage seines Grossherzogs in malerischer Tracht zur Gratulation antritt, und der die Initiative zu einer besonderen Ehrung BISMARCKS durch die Jenaer Universität ergreift. Der Wiener Soziologe GOLDSCHIED berichtet hingegen, wiesehr noch der greise Forscher als Ehrenpräsident des „Monistenbundes“ von alten Ansichten abrückte, und heute kann darauf verwiesen werden, dass diese grösste Vereinigung von Freidenkern in ihren Publikationen eine entschieden kriegsgegnerische, völkerversöhnende Tendenz ver-

folgte. Möge diese vor dem Kriege gestreute Saat in der Nachkriegszeit, die ihrer Früchte sosehr bedürftig ist, reich aufgehen und dem gegenseitigen Verständnis bei der Beurteilung auch dessen, was im Kriege geschah, den Weg bereiten.

(Brünn, Mähren.)

ERNST BLOCH.

B. Lepsius. *Deutschlands Chemische Industrie 1888—1913*, 108 S. in-8°. Berlin, GEORG STILKE, 1914.

Der Aufschwung der deutschen Industrie während der Regierungszeit WILHELMS II. ist eine Tatsache von so grosser geschichtlicher Bedeutung und derjenige der chemischen Industrie in diesem Rahmen ein so typisches Beispiel, dass die vorliegende Monographie dauernden Wert besitzt, obgleich sie aus einem Gelegenheitswerke stammt und unter dem Zeichen einer Geschichtsbetrachtung steht, die man als überwunden ansehen darf. Das Buch ist ein neubearbeiteter Beitrag zu einem Sammelwerke „Soziale Kultur und Volkwohlfahrt während der ersten 25 Regierungsjahre Kaiser WILHELM II.“. Nach einem längeren Exkurs in die Vorgeschichte wird das Gesamtgebiet der chemisch-industriellen Praxis des Vierteljahrhunderts durchschritten, die wichtigsten in Deutschland aufgefundenen Verfahren nach ihrer Entstehungsgeschichte geschildert, jeder Industriezweig an der Hand einer Fülle statistischer Daten in seiner Entwicklung verfolgt. Obwohl sich in dem Buche kaum prinzipiell Neues findet, wird doch das gedrängte Bild der innigen Verflechtung von Wirtschafts- und Geistesgeschichte sowie des Standes der angewandten Chemie im beginnenden zwanzigsten Jahrhundert auch dem Fachmann von Bedeutung sein.

(Brünn, Mähren.)

ERNST BLOCH.

Sir John Edwin Sandys. *A history of classical scholarship.* Vol. I. From the vith century B. C. to the end of the Middle Ages. Third edition. xxiv + 702 p., 24 illustr. Cambridge University Press, 1921.

The first edition of this volume appeared in 1903, and a second edition of it was called for in 1906, that is, before the completion of the work. Volumes II and III were published in 1908 and a complete summary of the whole work (A short history etc.), in 1915. As the author points out (p. 13), a knowledge of the history of classical scholarship «is indispensable to the student, and even to the scholar, who desires to make an intelligent use of the leading modern commentaries on classical authors which necessarily refer to the labours of eminent scholars in bygone days. And the study of that history is not without its in-

cidental points of interest, in so far as it touches on themes of such variety, and such importance, as the earliest speculations on the origin of language, the growth of literary and dramatic criticism at Athens, the learned labours of the critics and grammarians of Alexandria and Rome, and of the lexicographers of Constantinople. It has also its point of contact with the scholastic philosophy of the Middle Ages, with the revival of learning and the reformation of religion, and with the foundations of the educational systems of the foremost nations of the modern world » The subject has been divided into six sections (the dates are only approximate): (1) The Athenian age, from 600 to 300 B. C.; (2) The Alexandrian age, from 300 to the beginning of the Christian era; (3) The Roman age of Latin scholarship from 168 B. C. to 530 A. D.; (4) The Roman age of Greek scholarship from the beginning of the Christian era to 530 A. D.; (5) The Byzantine age, or the Middle Ages in the East, from 530 to 1350 A. D.; (6) The Middle Ages in the West, from 530 to 1350 A. D. It is out of the question to attempt a further summary of a work containing an enormous amount of information in a highly compressed form. Suffice it to say that it is exactly what we would wish such a work to be: it is accurate, clear, complete, yet never dull. A very pleasant feature is the insertion of twelve chronological tables which enable the student to take a bird's eye view of the development of scholarship at any given period.

The text of this third edition is substantially the same as that of the second but the author has submitted the whole volume to a careful revision. Special advantage was taken of LUDWIG TRAUBE's posthumous *Vorlesungen und Abhandlungen*, Munich 1909—1911, of KARL MANITIUS' *Geschichte der lateinischen Literatur des Mittelalters*, Bd. I, Munich, 1911 and of REMIGIO SABBADINI's *Le scoperte dei codici latini e greci*, vol. 2, Firenze 1914.

At a time when publishers are becoming more and more expert in the art of making a leaflet look like a grownup book and of selling it as such, it is a real comfort to get hold of a volume as compact and substantial as SANDYS' history. Praise to the Cambridge University Press!

G. SARTON.

Max C. P. Schmidt. *Kulturhistorische Beiträge zur Kenntnis des griechischen und römischen Altertums*. Erstes Heft: Zur Entstehung und Terminologie der elementaren Mathematik. Zweite verbesserte Auflage, xvi + 269 S. Leipzig, DUERR, 1914. Zweites Heft: Die Entstehung der antiken Wasseruhr, 113 S. Leipzig, DUERR, 1912.

MAX C. P. SCHMIDT is widely known as the author of a *Realistische Chrestomathie aus der Literatur des Klassischen Altertums* (1), that is.

(1) In three vol. Leipzig, DUERR, 1900—1901. Vol. I deals with mathematics; vol. II, with astronomy and geography; vol. III, with physics and technology,

a collection of Greek and Latin texts illustrating ancient science. From the beginning, his interest in Greek and Latin literature has been that of a true humanist, to whom no aspect of intellectual progress is indifferent. The two collections of learned monographs now under review afford further proof, if such were needed, of his deep interest in ancient science and technology. He tells us that his original aim was to write a history of Greek culture, but that he soon realized that such a history could not be satisfactorily written until a large amount of additional research had been accomplished. It was necessary to determine, for instance, the development of physical knowledge, the formation of geometrical ideas and propositions, the identification of ancient names of plants and animals with the modern ones, the signification and extent of Greek technology. It was equally indispensable to reach more definite conclusions on the relations between Greek civilization and the Mycenaean and Oriental civilizations. He was thus obliged to change his plans, and, instead of writing a comprehensive history, to undertake many special investigations. It is the results of these patient investigations that he is now offering us, to be used as materials for the historical synthesis of his dreams, when the time comes to build it.

The philological point of view is fundamental throughout the book, but Prof. SCHMIDT never forgets the reality which our words, however ancient they be, are meant to represent. He has tried to round out every topic which he has touched as completely as possible. His book is thus an incomplete collection of finished fragments.

The first volume dealing with the formation and terminology of elementary mathematics contains an introduction of 56 p., wherein he studies mathematical terminology in general, also the Greek concept of elementary mathematics and the influences to which early mathematics was subjected (in two chapters respectively entitled: Nil, Euphrat, Indus — Milet, Ephesos, Samos; SCHMIDT's conclusions are very conservative; he does not deny the possibility of Oriental influences, but considers them as entirely unproved, except as far as the initial stimulation received from Egypt is concerned). Then follows a series of philological monographs which I will simply enumerate: Punkt, Linie, Gerade, Fläche, Ebene, Grenze, Winkel. — THALES. — Lineal und Richtschnur, Lotstift und Lotschnur, Winkelmass und Zirkel. — PYTHAGORAS. — Die Seitenharmonie des PYTHAGORAS. — Herkunft des Wortes Hypotenuse. — Herkunft des Wortes Kathete. — Herkunft des Wortes Peripherie. — EUKLID. — Das Rechnen bei den Griechen. — Das Rechnen bei den Römern. — Herkunft des Wortes Summe. — Zur lateinischen Terminologie der elementaren Arithmetik.

The author's main conclusion is tersely expressed as follows: *Ex*

oriente lux, ex occidente lex. The initial ferment came from the East; the elaboration and codification took place in the West. It is very typical that our geometrical terminology is mainly of Greek origin, while our arithmetical words are mostly Latin; this may be taken as a good example of the sort of historical information crystallized in our language. The word algebra is Arabic, and that also is a tell-tale.

The second volume is more homogeneous, or at least has a more orderly appearance. It is entirely devoted to the ancient waterclock, the story of which is told in chronological sequence: (1) Introduction; (2) Description and history of the ancient clepsydra. Period of Dorian-Ionian philosophy; (3) Period of Attic logography; (4) Alexandrian and Roman period; (5) Conclusion.

Both volumes are divided into three main parts: the memoirs, the notes and the documentary texts (chiefly Greek). The first volume contains 65 p. of texts, the second, 30 p. The texts quoted in the latter are divided into four sections: the clepsydra as an observation instrument; the clepsydra as a clock; the clepsydra in Alexandrian and Roman times; ancient waterclocks.

GEORGE SARTON.

Paul Tannery. Mémoires scientifiques publiés par J. L. HEIBERG et H. G. ZEUTHEN. III. *Sciences exactes dans l'antiquité*, 3^{me} volume (1899-1913), xv + 419 p. Toulouse, EDOUARD PRIVAT, 1915.

Les deux premiers volumes de l'admirable monument élevé à PAUL TANNERY par la pitié de sa veuve ont été analysés dans *Isis*, I, p. 114-115, 509-512. Ces deux volumes, parus en 1912, contenaient soixante-cinq notes et mémoires relatifs aux sciences exactes dans l'antiquité classique, publiés de 1876 à 1898. Le troisième volume, qui contient vingt-cinq mémoires publiés de 1899 à 1913, complète la section de l'ouvrage relative à l'antiquité. Une analyse détaillée de ces mémoires prendrait trop de place; je dois me borner à les énumérer en intercalant quelques brèves remarques qui permettent au lecteur averti de se rendre compte du contenu de chacun d'eux. Toutefois, au lieu de signaler ces mémoires dans l'ordre où ils sont publiés, je les ai classés chronologiquement, conformément à la méthode d'*Isis*.

S. V. A. C.

A propos des fragments philolaiques sur la musique (p. 220-243). *Revue de philologie*, t. 28, p. 233-249, 1904. « En résumé, je serais porté à croire qu'en ce qui concerne les intervalles mélodiques, la musique grecque a subi dans les sept siècles de PYTHAGORE à PTOLÉMÉE une évolution sur laquelle les théories n'ont exercé qu'une influence d'autant plus faible qu'elles ont suivi les faits au lieu de les régler.

De ces théories, celle d'ARISTOXÈNE est restée lettre morte ; la lutte a existé en réalité entre deux écoles qui remontent l'une à PLATON (celle des canonicien classiques), l'autre à ARCHYTAS ».

S. IV. A. C.

Sur les problèmes attribués à ARISTOTE (p. 32-36). *Annales internationales d'histoire*, 5^{me} section. « Histoire des Sciences » 108-111. (Remarques faites au Congrès de Paris, 1900, à propos du travail de MAURICE GALLIAN.)

Y a-t-il un nombre géométrique de PLATON ? (p. 188-195). *Revue des études grecques*, t. 16, p. 173-179, 1903.

Sur un point d'histoire de la musique grecque (p. 90-96). *Revue archéologique*, t. 39, p. 49 54, 1902 — A propos d'un passage du περὶ μουσικῆς de PLUTARQUE. Ce texte, « en établissant, dès l'époque d'ARISTOXÈNE, l'altération des sons dits fixes, permet de supposer que les tonalités de notre mode majeur étaient dès lors introduites ; la même supposition peut naturellement être faite pour le mode mineur, qui n'entraînait qu'une altération des sons mobiles ».

Sur le spondiasme dans l'ancienne musique grecque (p. 299-309). *Revue archéologique*, t. 1, p. 41-50, 1911.

Un traité grec d'arithmétique antérieur à EUCLIDE (p. 244-250). *Bibliotheca mathematica*, t. 6, p. 225-229, 1905. A propos d'un fragment d'ARCHYTAS conservé par BOËCE. Le mémoire de 1904 sur les fragments philolaïques, cité plus haut, se rapporte aussi en grande partie à ARCHYTAS.

EUDOXE (p. 366-369). Article de la *Grande Encyclopédie* (c. 1893).

S. III A. C.

Inauthenticité de la « Division du canon » attribuée à EUCLIDE (p. 213-219). *Comptes Rendus de l'Académie des inscriptions*, t. 4, p. 439-445, 1904.

EUCLIDE (p. 362-366). Article de la *Grande Encyclopédie* (c. 1893).

PORISME (p. 374-377). *Idem.* (c. 1900).

APOLLONIUS (p. 322-325). *Idem.* (c. 1887).

ARCHIMÈDE (p. 326-329). *Idem.* (c. 1887).

CONON (p. 353-354). *Idem.* (c. 1891).

ERATOSTHÈNE (p. 358-362). *Idem.* (c. 1893).

S. II A. C.

L'invention de l'hydraulis (p. 282-298). *Revue des études grecques*, t. 21, p. 326-340, 1908. (Mémoire inachevé complété par une note du baron CARRA DE VAUX.)

S. I A. C.

Le philosophe AGANIS est-il identique à Geminus? (p. 37-41, 379.) *Bibliotheca mathematica*, t. 2, p. 9-11, 1901.

Compte rendu du t. III des œuvres de HÉRON D'ALEXANDRIE, édité par HERMANN SCHÖNE (p. 131-157). *Journal des Savants*, p. 147-157, mars 1903 et p. 203-211, avril 1904.

Notes critiques sur les *Metrica* de HÉRON (p. 196-207). *Revue de philologie*, t. 28, p. 181-188, 1904.

CLÉOMÈDE (p. 351-353). Article de la *Grande Encyclopédie* (c. 1891).

S. I.

Sur la sommation des cubes entiers dans l'antiquité (p. 116-118). *Bibliotheca mathematica*, t. 3, p. 257-258, 1902. (Se rapporte à la proposition de NICOMACHE qui est probablement plus ancienne.)

ANATOLIUS sur la décade et les nombres qu'elle comprend (p. 12-31). *Annales internationales d'histoire*, 5^e section, p. 42-57. Congrès de Paris, 1900. (Suivi de deux appendices publiés en 1899 et 1905.)

ANATOLIUS d'Alexandrie (p. 321-322). Article de la *Grande Encyclopédie* (c. 1887).

Note sur le problème de PAPPUS (p. 42-50). Extrait des œuvres de DESCARTES publiées par ADAM et TANNERY, t. 6, p. 721-725, 1902.

DIOPHANTE (p. 355-358). Article de la *Grande Encyclopédie* (c. 1892).

S. V.

Le manuel d'introduction arithmétique du philosophe DOMNINOS de Larissa (p. 255-281). *Revue des études grecques*, t. 19, p. 360-382, 1906. (traduction et commentaire).

Note sur *Anonymi fragmentum de revolutionibus lunae* publié par Ch. E. RUELLE (p. 310-311). *Catalogus codicum astrologorum graecorum*, t. 8, p. 125, Bruxelles, 1911. (Ce texte avait été publié *ibidem*, p. 126-134.) " Il semble impossible de faire descendre ce fragment jusqu'à l'époque de THÉODORE DE MELITÈNE (*i. e.*, c. 1361), car il ne renferme aucun indice de connaissance de l'astronomie persane ou arabe... ; la langue et la valeur du fragment permettent bien plutôt de le faire remonter au v^e ou vi^e siècle. "

S. VI.

SIMPLICIUS et la quadrature du cercle (p. 119-130). *Bibliotheca mathematica*, t. 3, p. 342-349, 1902.

Astronomie.

Le Cadran de Carthage (p. 1-11). *Comptes rendus de l'Académie des Inscriptions*, t. 27, p. 38-48, 1899. A propos du cadran plan du Musée des Pères Blancs à Carthage, différent des cadrans solaires grecs analogues.

Astronomie (p. 335-351). Article de la *Grande Encyclopédie* (c. 1887).
(Brève histoire de l'astronomie.)

Mathématiques.

Du rôle de la musique grecque dans le développement de la mathématique pure (p. 68-89). *Bibliotheca mathematica*, t. 3, p. 161-175, 1902.

Notions historiques (p. 158-187). Extrait des Notions de Mathématiques de JULES TANNERY, p. 322-348, Paris, 1903. Brèves notes d'histoire sur les sujets suivants : 1. Origines de l'algèbre. — 2. Sens des mots analyse et synthèse chez les Grecs et leur algèbre géométrique. — 3. Quantités positives et négatives. — 4. Courbes étudiées par les anciens. — 5. Origine de l'emploi des coordonnées pour la représentation graphique de la variation des phénomènes. — 6. Origines du calcul infinitésimal.

Symbole de soustraction chez les Grecs (p. 208-212). *Bibliotheca mathematica*, t. 5, p. 5-8, 1904.

Trois manuscrits grecs mathématiques de Turin (p. 251-254). *Revue des études grecques*, t. 18, p. 207-210, 1905.

Arithmétique (p. 330-335). Article de la *Grande Encyclopédie* (c. 1887).

Géométrie (p. 370-374). *Idem.* (c. 1894).

Porisme (p. 374-377). *Idem.* (c. 1900).

Musique.

Plusieurs mémoires cités plus haut se rapportent à la musique grecque (ARISTOXÈNE, ARCHYTAS, EUCLIDE). Voir par exemple le premier mémoire du paragraphe précédent.

Sur les intervalles de la musique grecque (p. 97-115). *Revue des études grecques*, t. 15, p. 336-352, 1902.

L'évolution des gammes antiques (p. 312-320). Œuvre posthume inédite publiée par les soins de Th. REINACH, suivie d'une lettre à EDMOND GOBLOT (1896) sur la musique grecque (reproduite en fac-similé).

Physique. Métrologie.

MENSURA (μέτρον, mesure) (p. 51-67). Article du *Dictionnaire des antiquités grecques et romaines* de DAREMBERG et SAGLIO, t. 3, p. 1727-1731, 1902.

Ce volume est orné d'un portrait de TANNERY lycéen en 1859 (un crayon d'ARMAND BERTON d'après une photographie) et il se termine par un copieux index des tomes I à III.

G. S.

Paul Tannery. Mémoires scientifiques publiés par J. L. HEIBERG. IV. *Sciences exactes chez les Byzantins* (1884-1919), xv + 442 p., 9 planches. Toulouse, EDOUARD PRIVAT, 1920.

Pour ce qui concerne les trois volumes précédents, voir plus haut mon compte rendu du t. III. Je me propose d'analyser le volume IV en suivant la même méthode. Ce volume est d'un intérêt peut-être encore plus grand que les précédents, car tandis que la science grecque commence à être assez bien connue, la science byzantine a encore tout le mystère et le charme des domaines à peine explorés.

S. VI.

Notes critiques sur le traité de l'astrolabe de PHILOPON (p. 241-260). *Revue de philologie*, t. 12, p. 60-73, 1888. Ce traité a été publié par H. HASE dans le *Rheinisches Museum* de 1839, p. 127-171, mais cet éditeur n'en a pas bien compris toute l'importance. Si l'on tient compte de ce que le Planisphère de PTOLÉMÉE est un ouvrage purement théorique, le traité de JEAN D'ALEXANDRIE, dit PHILOPON, est le premier qui ait été consacré à l'astrolabe et le seul qui nous soit parvenu de l'antiquité. L'instrument décrit par PHILOPON (ἀστρολάβος) était déjà aussi perfectionné qu'il l'a jamais été par les Arabes.

S. XI.

PSELLUS sur la grande année (p. 261-268) *Revue des études grecques*, t. 5, p. 206-211, 1892. — Les chiffres donnés par PSELLUS dans sa *Διδασκαλία παντοδαπῇ* (éd. FABRICIUS, 1712) dérivent sans doute de la Syntaxe de PTOLÉMÉE.

PSELLUS sur les nombres (p. 269-274). *Ibidem*, t. 5, p. 343-347, 1892. Texte inédit *περὶ ἀριθμῶν* tiré d'un MS. de l'Escorial. Ce texte est une analyse ou un résumé des trois livres (V, VI, VII) que JAMBLIQUE avait consacrés à la Physique, à l'Ethique et à la Théologie dans son grand ouvrage sur la secte pythagorique dont il ne nous reste que les quatre premiers livres.

PSELLUS sur DIOPHANTE (p. 275-282), *Zeitschrift für Mathematik und Physik, Hist. Liter. Abt.*, t. 37, p. 41-45, 1892. Fragment inédit tiré de MSS. de l'Escorial et de la Laurentienne. La méthode algébrique de DIOPHANTE y est étrangement appelée analyse égyptienne (ἡ κατ Αἰγυπτίους μέθοδος, ἡ Αἰγυπτιακὴ ἀνάλυσις). DIOPHANTE est antérieur à ANATOLIUS.

S. XII.

THEODORE PRODROME. Sur le grand et le petit (Α ΙΤΑΛΙΚΟΣ). Texte grec inédit et notice (p. 207-222). *Annuaire de l'Association pour l'encou-*

ragement des études grecques en France (p. 104-119, 1887). PRODROME, écrivain et commentateur d'ARISTOTE, vivait au début du XII^e siècle. Le texte édité par TANNERY et tiré de MSS. de la Bibliothèque nationale est consacré à réfuter un passage des Catégories où ARISTOTE a placé le grand et le petit, le beaucoup et le peu dans la catégorie du πρὸς τι et non pas du πρὸς ὅν, où il a nié que ces termes fussent respectivement contraires entre eux.

S. XIV.

MANUEL MOSCHOPOULOS et NICOLAS RHABDAS (p. 1-19). *Bulletin des sciences mathématiques*, t. 8, p. 263-277, 1884.

Le traité de MANUEL MOSCHOPOULOS sur les carrés magiques. Texte grec et traduction (p. 27-60). *Annuaire de l'Association pour l'encouragement des études grecques*, p. 88-118, 1886. Ce texte a été publié pour la première fois par SIEGMUND GÜNTHER (*Vermischte Untersuchungen zur Geschichte der mathematischen Wissenschaften*, Leipzig, p. 195-203, 267-268, 1876), mais d'après un mauvais MS. de Munich. Ce traité a dû être écrit au début du XIV^e siècle; il est dédié à RHABDAS; c'est le plus ancien document connu de la tradition grecque sur les carrés magiques, tandis que ceux-ci étaient déjà connus par les Arabes au X^e siècle. Furent-ils découverts par les Arabes? Le traité de MOSCHOPOULOS ne décelle aucune influence arabe. Le texte publié par TANNERY est basé sur un MS. de la Bibliothèque nationale.

Notice sur les deux lettres arithmétiques de NICOLAS RHABDAS. Texte grec et traduction (p. 61-198). *Notices et extraits de la Bibliothèque nationale*, t. 32, p. 121-252, 1886.

Astronomie.

Les noms de mois attiques chez les Byzantins (p. 222-239). *Revue archéologique*, t. 9, p. 23-36, 1887.

Les éphémérides chez les Byzantins (p. 289-293). *Bulletin des sciences mathématiques*, t. 30, p. 59-60, 1906.

Mathématiques.

Le scholie du moine NÉOPHYTOS sur les chiffres hindous (p. 20-26). *Revue archéologique*, t. 5, p. 99-102, 1885.

Les chiffres arabes dans les manuscrits grecs (p. 199-205). *Ibidem*, t. 7, p. 355-360, 1885.

Le calcul des parties proportionnelles chez les Byzantins (p. 283-287). *Revue des études grecques*, t. 7, p. 204-208, 1894.

Chiffres, histoire (p. 413-421). Article de la *Grande Encyclopédie*, vers 1891.

Superstitions médiévales

Le Rabolion (œuvre posthume). Traités de géomancie arabes, grecs et latins (p. 295-411). — La géomancie est un procédé de divination à l'aide de sable (on marque des points au hasard sur une surface de sable et on interprète les figures formées par ces points. Je n'indique que le principe; l'opération même est assez compliquée). Cette superstition est d'origine arabe. Les Arabes appelaient la « science du sable » *raml* d'où dérive le mot byzantin *δαβόλιον*. Quant au mot *geomantia* (*γεωμαντεία*) il n'a été découvert dans aucun texte grec ancien; on le trouve pour la première fois dans un fragment de VARRON cité par ISIDORE DE SÉVILLE (*Etym.*, VIII, 9, 13). TANNERY émet l'hypothèse que ce mot fut employé pour la première fois pour désigner le *raml* par HUGO SANCCELLIENSIS, un des traducteurs de l'arabe en latin. Si comme le dit TANNERY, HUGO vivait vers le milieu du ^{xiii} siècle, son traité de géomancie serait le plus ancien de l'Occident (1). L'étude de la géomancie dérive la plus grande partie de son intérêt du fait qu'elle nous donne l'occasion de comparer des développements contemporains arabes, byzantins et latins. Le grand mémoire (en partie inachevé) de TANNERY se compose de quatre parties : la première due au baron CARRA DE VAUX est un examen de la géomancie arabe (avec reproduction fac-similé de trois talismans arabes); la seconde contient des études sur l'histoire du mot *géomancie*, le traducteur HUGO SANCCELLIENSIS, l'*Ars geomantiae*, la *Geomantia nova* et la technique de la géomancie; la troisième relative à la géomancie byzantine, nous donne le texte de deux MSS. grecs de la Bibliothèque nationale; la quatrième relative à la géomancie occidentale, contient le texte de deux MSS. latins, l'un de la Bibliothèque nationale, l'autre de la Laurentienne.

Je dois encore citer, pour compléter cette analyse, une note « sur le projet d'un Corpus des humanistes byzantins » (p. 422-428). C'est le projet formulé d'abord par LUDWIG STEIN au Congrès d'histoire de Rome en 1903. A-t-il reçu un commencement d'exécution? Il y aurait sans doute un très grand intérêt à rassembler les textes (2) de la grande renaissance byzantine qui, provoquée par le sac de Constantinople par les Croisés en 1204, s'accusa vers le milieu du ^{xiii} siècle et s'épanouit au ^{xv}°, au moment même où la civilisation byzantine va succomber devant l'islamisme. PAUL TANNERY préparait lui-même l'édition du traité de GEORGES PACHYMÈRE (1242-1310) sur les quatre

(1) WÜSTENFELD rangeait HUGO arbitrairement parmi les traducteurs du ^{xiv} siècle (*Die Uebersetzungen arabischer Werke*, p. 120-121, 1877).

(2) Il faudrait les cataloguer tous avec résumés et extraits étendus et publier les principaux *in extenso*.

sciences (sauf la musique déjà publiée). Il écrivait à DIELS en 1886 qu'il avait déjà 450 pages de texte grec prêtes pour l'impression. Qu'est devenu ce travail ?
G. S.

Raphaël Petrucci († 1917). *Kiai Tseu Yuan Houa Tchouan*. Les enseignements de la peinture du jardin grand comme un grain de moutarde. Encyclopédie de la peinture chinoise. Traduction et commentaires, augmentés d'une préface, d'un dictionnaire biographique des peintres et d'un vocabulaire des termes techniques. In-f°, XII+519 p., env. 500 grav. Paris, HENRI LAURENS, 1918.

[300 fr.]

Le sous-titre donné par le très regretté PETRUCCI à la traduction de cet ouvrage n'est pas du tout une exagération, car le *Kiai tseu yuan houa tchouan* constitue une véritable encyclopédie de la peinture chinoise. L'historien de la pensée asiatique le lira avec beaucoup d'intérêt, car le texte nous révèle à tout moment des aperçus nouveaux sur les conceptions que les Chinois se font de l'univers. Certaines de ces conceptions ont une base scientifique, d'autres sont purement magiques (par exemple les idées sur le regard, à propos de la peinture des yeux). L'ouvrage nous donne le résultat d'études analytiques poursuivies pendant des siècles avec un bon sens et une méthode admirables ; — bien souvent elles évoquent celles entreprises par LÉONARD DE VINCI, et le fait que nous ne trouvions pas d'autre point de comparaison en Occident est significatif. Mais aux résultats de ces recherches positives sont inextricablement mêlées des conceptions philosophiques — taoïstes et bouddhistes ou plus anciennes encore — qui donnent au livre une saveur étrange, comparable à celle que nous inspirent les vieilles peintures chinoises elles-mêmes. Rappelons-nous à ce propos que l'œuvre de LÉONARD est elle aussi saturée de pensées médiévales, que lui aussi ne peut s'empêcher de comparer sans cesse le macrocosme et le microcosme et que pour lui tout autant que pour l'artiste chinois la montagne était une chose vivante d'une vie cachée : l'eau circulant à l'intérieur étant comme le sang qui se meut dans notre corps. Le premier livre est tout particulièrement intéressant. Il nous offre d'abord un résumé de l'esthétique chinoise : nous y retrouvons, par exemple les six principes énoncés par SIE HO au ^v^e siècle, éclairés cette fois par un admirable commentaire de PETRUCCI. Ensuite une série de chapitres sur les encres, les couleurs, les procédés d'atelier, les papiers, les soies nous permettent d'apprécier l'évolution des arts et métiers en Chine. (La troisième partie du livre IX doit être rapprochée de la fin de l'introduction, qu'elle complète et corrige.)

Le *Kiai tseu yuan houa tchouan* dans sa forme actuelle date de la fin

du XVII^e siècle. L'édition princeps de la première partie date de 1679, celle de la seconde partie parut en 1701 (1). Mais les éléments en sont beaucoup plus anciens, car cet ouvrage n'est en somme qu'une codification de la tradition chinoise. Le premier noyau de l'ouvrage fut constitué par un ensemble de planches relatives au dessin du paysage accompagnées d'un texte explicatif par le peintre LI TCH'ANG HENG (ou LI LIEOU-FANG, né à Kia-ting en 1575, mort en 1629). Cet album faisait partie des collections de CHEN SIN-YEOU (appellation, YIN-PO), le possesseur du jardin *Kiai tseu* (duquel notre ouvrage dérive son nom) à Nankin. Grâce à ses efforts et à ceux de son beau-père LI YU, le *Kiai tseu yuan* devint un véritable centre de publications d'art. Ce LI YU (appellation, LI-wong) était un écrivain et un critique, il vivait à la fin du XVII^e siècle et au commencement du XVIII^e. C'est à lui et à CHEN SIN-YEOU que nous devons la rédaction du *Kiai tseu yuan houa tchouan*. Ils se firent aider des trois frères WANG, artistes et archéologues distingués : le plus jeune, WANG YE (appellation, SSEU-TCHE); WANG NGAN-TSIE (aussi appelé LOU-TCH'AI); l'aîné, WANG CHE (appellation, FOU-TS'AO). La seconde partie (livres VI à XI) fut rédigée avec la collaboration des deux peintres WANG YUN-NGAN et TCHOU CHENG (JE-JOU). Cet ouvrage eut un très grand succès et fut souvent réédité en Chine et au Japon. La traduction de PETRUCCI a été établie sur l'édition lithographique de Changhai, 1887, mais il a pu en collationner le texte et les planches avec l'édition princeps de 1679 pour ce qui concerne les cinq premiers livres et avec la réédition de 1782 pour le reste.

Le *Kiai tseu yuan* est divisé en onze livres, comme suit : I. Introduction générale (j'en ai parlé plus haut). — II. Les arbres. — III. Les pierres. — IV. Les Jen-wou (les hommes et les choses tels qu'ils apparaissent dans le paysage). — V. Exemples de peintures de paysage. — VI. La peinture des iris et des orchis. — VII. Les bambous. — VIII. La peinture de prunier. — IX. Les chrysanthèmes. — X. Plantes herbacées (sans le bambou) et insectes. — XI. Plantes ligneuses et oiseaux.

Dans chacun des chapitres II à XI, l'auteur fait une analyse pénétrante de la structure des objets considérés du point de vue pictural. Il montre ensuite comment chacun des grands peintres chinois a représenté les détails de cette structure ou de quelle manière il en a fait la synthèse. Comme le remarque PETRUCCI, ces études très précises et accompagnées de croquis nombreux, seront fort utiles aux amateurs qui voudront identifier les vieux tableaux chinois en suivant les méthodes morelliennes. Mais hélas, elles ont été beaucoup plus utiles encore aux faussaires à qui elles ont expliqué en détail la manière de

(1) Ces deux éditions contiennent des planches en couleur d'une grande beauté.

ressusciter les vieux maîtres ! Considérons, par exemple, la peinture de prunier. Les explications données par le peintre SONG T'ANG TCHENG-TCHONG (appellation CHOU-YA) sont particulièrement remarquables (p. 292) : « l'étude de la forme est tellement précise qu'elle nous livre ici une anatomie de la fleur avec chacune de ses parties dénommées. Si le terme chinois *ling* qui correspond au calice, s'étend au pédoncule et ne comprend pas les sépales, il n'en est pas moins vrai qu'à chacun des termes chinois, nous pouvons faire correspondre un terme précis de notre botanique et cela suffit à montrer la précision et la clairvoyance d'une recherche instaurée dans un but purement esthétique ». — Mais comme je le remarquais plus haut, ces analyses pénétrantes sont généralement suivies de considérations métaphysiques abstruses basées sur la comparaison de chacun des organes de la plante avec divers éléments cosmiques (le chapitre VI du livre du prunier est un cas extrême).

R. PETRUCCI a accompagné la traduction de notes nombreuses et d'un commentaire érudit et perspicace. De plus il y a ajouté deux index qui sont de vrais dictionnaires : un vocabulaire des termes techniques (p. 447-462) ; un dictionnaire biographique des peintres et personnages cités dans le texte ou les notes (p. 463-509). On remarquera qu'en dehors de l'introduction qui a une portée tout à fait générale, l'ouvrage est dévoué uniquement à la peinture de paysage. Mais l'intention de CHEN SIN-YEOW n'était point de s'en tenir là. Dans la préface de l'édition de 1701, il annonçait la publication d'une dernière partie consacrée à la peinture de figure. Toutefois, ce ne fut que plus d'un siècle plus tard, en 1818, que cette dernière partie fut publiée. Le texte en était dû au peintre TING KAO. PETRUCCI se proposait de traduire cette dernière partie et d'en faire le centre d'une nouvelle publication qui aurait été le complément de la première. Hélas ! ce beau projet comme tant d'autres fut anéanti par la mort et sans doute de longues années se passeront avant que les qualités scientifiques et artistiques indispensables soient de nouveau réunies dans une autre âme.

En résumé, la *Kiai tseu yuan houa tchouan* intéressera beaucoup les historiens de la pensée chinoise ; aux historiens de l'art chinois elle est absolument indispensable.

G. SARTON.

Mieli, Aldo. *I Prearistotelici*. I (Storia generale del pensiero scientifico dalle origini a tutto il secolo XVIII; La scienza greca), xvi + 503 p. Firenze, Libreria della Voce, 1916.

The diversity of interest and the breadth of training of ALDO MIELI are well attested by the notable contributions which he has made to the history of Chemistry, to the history of Philosophy, and to the

general history of Science. Of equal value has been the stimulus which he has given in Italy to the history of science, so that a whole series of publications by other writers can be directly traced to his enthusiasm.

The present volume is dedicated to GEORGE SARTON « per l'eroica sua patria, per il suo esilio doloroso, riaffermando su queste pagine di studi sereni la condanna dell'antica rinnovata follia : La Guerra. »

It is the first of a series devoted to the history of scientific thought from its origins to the end of the XVIIIth century. Whether the monumental project conceived be completed or no, the fundamental value of this contribution cannot be disputed. Even the statement of the project is a contribution of no mean value.

This study of Greek science before ARISTOTLE, as a whole, is made, fortunately, from the point of view of one acquainted with the earlier contributions made by Babylonians and Egyptians and by one who is fully conscious of the fact that science is universal in its appeal and in its development. Too often Greek science is discussed by those whose limited acquaintance with the development of science as a whole has led to a contemptuous attitude towards the contributions to early science of others than the Greeks.

The book suffers in spots somewhat from a characteristically Italian diffuseness of treatment. It is a generous fault, enjoyed by LEONARD OF PISA, 1202, in his almost too monumental *Liber Abaci*, by COSSALI 1797, in his *Origini, trasporto in Italia, primi progressi in essa, dell'Algebra*, and more recently by CAVERNI in his *Storia del Metodo sperimentale*.

This monograph treats in 503 pages the Ionic School, the Pythagorean School, and the Eleatic School and HERAKLEITOS; two further volumes are to be devoted to the pre-Aristotelian period, to EMPEDOKLES, ANAXAGORAS, the medical scientists and the atomists, and to the formation of the ancient Greek mathematics and astronomy, the Sophists and PLATO, respectively.

The work is a study of scientific ideas, largely free from the biographical details with which many writers divert themselves from the history of science. Here and there one may dispute the assertions of the author. Thus the absolute rejection of the accounts of PYTHAGORAS by PORPHYRY and IAMBlichus is of late somewhat modified. To assert (p. 5) that Egyptian influence upon Greece began only after PSAMMETIK (c. 656 B. C.) is questionable, particularly in view of the recent Cretan discoveries.

The systematic consideration of the geographical, biological, psychological, astronomical, and mathematical developments among the early Greeks, with the proper background of philosophy, constitutes

the most noteworthy advance of MIELI's work over any other study of Greek science which has yet been attempted. Whether it will be possible for one individual to continue such comprehensive studies of scientific ideas to the end of the eighteenth century with anything approaching the thoroughness and scholarship of this volume is highly problematical. The mass of literary material becomes too enormous to be encompassed within an ordinary lifetime.

The bibliography, making no pretence of completeness, nevertheless presents, in brief characterizations of a large number of works, material which is of great value to any student of Greek thought and achievement in relation to the general history of science.

The further volumes of this undertaking, two of which are said to be nearly ready for the press, are anticipated with the expectation that they also will mark, as this volume does, definite advancement in the serious study of the intellectual history of man.

(*University of Michigan.*)

LOUIS C. KARPINSKI.

Arabian Medicine, being the FITZPATRICK Lectures delivered at the College of Physicians in November 1919 and November 1920, by EDWARD G. BROWNE, M. B., F. R. C. P., Sir THOMAS ADAMS's professor of Arabic in the University of Cambridge, VIII+138 p., Cambridge, at the University Press, 1921.

In this most interesting and valuable book almost the only thing to which serious exception can be taken is the title. That can only help to perpetuate the unhappy delusion, far too common in our encyclopedias and books of reference, that the Mohammedan civilization was racially and geographically Arabian; while it may be asserted most absolutely that there never existed any such things, in a scientific sense, as an Arabian philosophy, an Arabian art, an Arabian science or, as in this case, an Arabian medicine. These sprang up in the Mohammedan civilization, but were the contributions of other races and countries and were connected with Arabia only by being written in a form of the Arabic language. They were no more Arabian than the works, though written in Latin, of a ninth century Irish monk in Ireland were Roman. It is true that Professor BROWNE knows this and explains it most carefully in the opening pages of his book. But the mischief of popular miscomprehension has already been done; and the title of a book goes much farther than the book itself.

A complete history of Moslem medicine is, of course, impossible in these 126 pages of text. We have only a sketch; but such headings as « evolution of scientific terminology in Arabic », « psychothera-

peusis », « School of Toledo », « dissection in Moslem lands », « Moslem hospitals », « fees of physicians », « dropsy cured by a diet of locusts », « early tradition of anaesthesia », will show how high is its interest. Prof. BROWNE rightly believes in anecdotes and has accumulated a number of striking « clinical cases » from Arabic and Persian records. Even the *Arabian Nights* in the Tale of TAWADDUD is drawn in. Of the physicians whose lives and methods are described AVICENNA we all know, but RAZI, a far greater name, will probably be new to non-orientalists, in spite of the several European editions of his masterly study of small-pox and measles. When, in next year's FITZPATRICK lectures, Prof. BROWNE treats in detail, as he promises, the « Qanūn » of AVICENNA it might be well, for the general *mise en scène* of his subject, to deal specifically with two matters : the relation of the physician to the physicist and the relation of both to the magician. For these AVICENNA, who had in him a dash of the systematizer and also of the charlatan, is an excellent starting point. Professor BROWNE, of course, knows the popular romances in Turkish and Arabic — probably, too, in Persian — of the life of AVICENNA, the magician. If he will compare these with the medieval European lives of VIRGILIUS the magician, he will notice how closely they agree in incidents and that there can be little or no doubt of a close relationship. Other sides of Mohammedan medicine which invite further study are hypnotism, evidently referred to as *ilm at-tawahhum* in the « Fihrist » (p. 309, l. 12, p. 312, l. 25) and the *kutub al-bāh*, the Moslem equivalent for our « self and sex » books. It would be highly interesting to know how professed physicians formally dealt with such subjects. To the first Prof. BROWNE makes general reference as « psychotherapeusis » (p. 82 ff.) and « suggestion » (p. 90); but there was evidently a specific and at least semi-scientific literature, derived allegedly from India. Does hypnotism, it may be worth while to ask, appear in Greek medicine? There are some little details which might be considered in a future edition. IBN KHALDŪN (p. 7) was almost certainly a Berber, not an Arab; to call the body of traditions of the sayings and doings of MOHAMMED « carefully authenticated » (p. 12) suggests at least that they are trustworthy — of course they are not; it is a grave misunderstanding of the development of Moslem thought to describe the Mu'tazila school of theology as « more liberal » (p. 5), although HORTEN uses the term regularly; see, to the contrary, GOLDZIHNER'S « *Vorlesungen* », p. 117; read ABU' I-HASAN (p. 31 foot), in spite of PAYNE and BURTON, and IBN BATTŪTA (p. 101).

There is an admirable 12 page index.

D. B. MACDONALD.

Hovelaque, Émile. — *Les peuples d'Extrême-Orient. — Le Japon.*
(Bibliothèque de philosophie scientifique), 344 p. Paris, FLAMMARION, 1921, [fr. 7.50.]

Ce livre qui fait suite au livre sur la Chine dû au même auteur, est comme ce dernier une sorte de petite encyclopédie, — fort claire, pénétrante, sympathique, et qui n'a qu'un défaut, notamment celui d'être trop condensée. La thèse fondamentale de l'auteur c'est que l'idéal japonais n'est point, comme celui d'autres peuples, un idéal religieux ou moral, mais plutôt un idéal esthétique. M. HOVELAQUE est évidemment fort bien documenté, et il a cette faculté rare, surtout en France, de voir les peuples étrangers non de son point de vue à lui, mais de leur point de vue à eux. Il est clair que sans cette faculté il ne peut y avoir de vraie compréhension ni de vraie sympathie. Le livre VI consacré au Japon moderne, m'a spécialement intéressé, parce qu'il était pour moi le plus neuf. L'on ne peut s'empêcher de frémir en songeant à la tragédie terrible qui se déroule en ce moment dans ces îles privilégiées : comment la vieille âme japonaise parviendra-t-elle à se garantir contre les progrès sinistres de l'industrialisme et du matérialisme que lui impose la défense même de son existence ?

Les jugements de M. HOVELAQUE sont généralement clairs et profonds, mais on ne peut que regretter que son éducation exclusivement littéraire ne lui permette point de voir les questions de race sous leur vrai jour. Ces questions sont essentiellement d'ordre biologique. Ce qui fait la force de la culture japonaise, c'est l'extrême pureté de sa race. Cette pureté est aussi la source de son style. De même c'est enfantin de parler de l'impérialisme allemand comme d'une création artificielle : l'impérialisme allemand tout comme l'impérialisme japonais était essentiellement un résultat, non pas une cause. L'impérialisme des peuples est comme l'ambition des hommes, une conséquence naturelle de leur vigueur. Cet impérialisme ou cette ambition collective est tout à fait comparable à une pression hydrostatique ou un potentiel. Il existe une tension vers l'équilibre qui augmente avec la différence de potentiel ; si l'équilibre ne peut se rétablir normalement et si la différence de potentiel s'aggrave, une décharge violente devient inévitable. Dans le cas des peuples, cette décharge n'est autre que la guerre.

J'aime beaucoup l'esprit du livre de M. HOVELAQUE. Je pense comme lui que la connaissance du Japon, comme celle de la Chine, enrichit notre âme. Elle nous enrichit par le sentiment des différences qui nous séparent, et plus encore par la découverte des trésors qui nous sont communs. Mais M. HOVELAQUE n'a pas aperçu la difficulté essentielle du problème, due à la contradiction suivante : tandis que l'étude

de l'idéal asiatique est extrêmement désirable — et cela implique des rapports plus nombreux et plus intimes entre eux et nous, — il n'en est pas moins vrai que le mélange des races serait absolument funeste. De cette opposition fondamentale résulteront tôt ou tard des différences de potentiel formidables et probablement des calamités qu'il est impossible de s'imaginer. Ce problème m'angoisse plus que je ne puis le dire, et je m'étonne que l'auteur ne l'ait pas même effleuré.

Sous cette réserve, ce petit livre est excellent, et il aurait suffi d'y ajouter un index pour justifier l'assertion des éditeurs, qu'il constitue un manuel complet du Japon ancien et moderne.

GEORGE SARTON.

Mediaeval contributions to modern civilisation. A series of lectures delivered at King's College, University of London. Edited by F. J. C. HEARNshaw, M. A., LL.D. with a preface by ERNEST BARKER, M. A., 268 p. London, HARRAP, 1921. [10s. 6d.]

The foregoing title, doubtless devised to attract the narrow glance and to flatter the self-sufficiency of the average present-day reader, had the effect rather of prejudicing the reviewer against the work, for how can anyone do justice to medieval civilisation who enumerates only those features which have contributed to modern civilisation? This initial prejudice was aggravated by an advertisement on the wrapper that « The standpoint of this book is the present day », and more to the same effect, and by an approving quotation on the first page of Prof. HEARNshaw's introductory chapter of what, let us hope, is the silliest thing that Lord MORLEY ever said, namely, « I do not in the least want to know what happened in the past, except as it enables me to see my way more clearly through that which is happening today ». (1) Are we to delete from knowledge's *ample page* everything which is not concerned with the happenings of the moment? That attitude has cost us many a precious manuscript and stained glass window and would in the end leave us nothing whatever. We must know everything possible of the past, for it may enable us to cope the better with what will happen, not today only, but tomorrow and next day and the day after *ad infinita saecula saeculorum, Amen*.

Fortunately most of the authors of the ten lectures on the middle ages and their religion, philosophy, science, art, poetry, education, society, economics, and politics, have refused to be fettered by the

1 It is essentially the same attitude as that quoted at page 130 of our text from St. AMBROSE, « To discuss the nature and position of the earth does not help us in our hope of life to come ».

limitations of the title and have been free to point out gaps and sores where modern civilisation might with profit borrow balm and ballast from medieval. At the same time they frequently guard against the danger of idealising the middle ages, and the book as a whole is characterized by sound English common sense, many acute observations, and frequent flashes of wit and humor. There is not much new matter in most of these lectures, but something rather fine informs them all, and the sympathetic presentation of medieval thought and ways is accompanied by brave hopes for a better social structure and economy of our own and a somewhat surprising faith in the possibility of common action and democratic culture.

Indeed, the chief general criticism which I have to make turns out to be — rather inconsistently — that the authors have not kept as close to their title as they might. They have largely dwelt upon mental attitudes which moderns have taken or might take over from the middle ages, or which have been remote but not to be forgotten starting points of modern development, and upon « spiritual » things such as hymns and universities. But our modern civilisation is notoriously materialistic and motor. « Let's go » is its favorite slogan. Why not date this spirit back to barbarian invaders and Norse vikings, or to pilgrims and crusaders? Why is there no lecture on medieval geographical expansion and progress in navigation? Why are not the concrete things invented in the medieval period mentioned? For instance, why are not the material comforts of the modern home connected with medieval chimneys and plumbing and glass windows? Or the trench hats and artillery of the recent war with feudal armor and the invention of gunpowder?

Gunpowder is mentioned in that chapter of the book which is of closest interest to the readers of *Isis*, namely, Dr. CHARLES SINGER's sketch of science through the middle ages. This tends to correct an earlier assertion (at p. 39) that « No idea of any order in nature, or any conception of the sequence of cause and effect, awoke a scientific scepticism in the medieval mind », but Dr. SINGER might have made more of alchemy and of the experimental tendency during the middle ages as a contribution to modern science than he does. In the main, however, considering its necessary brevity, his outline seems as comprehensive and well proportioned as could be expected, and he does well to emphasize the dominance of the astrological hypothesis in medieval science. In the main, too, his account keeps abreast of the most recent investigation in the field and contains more new matter than most of the chapters; indeed, he perhaps dates or locates some medieval scientists a little too definitely. His suggestion as fairly clear-cut dividing dates between ancient and medieval and medieval

and modern science of the deaths of PROLEMY and GALEN and the year 1543, when appeared the fundamental works of VESALIUS and COPERNICUS, is noteworthy, if not entirely convincing. So is his observation, « I seriously doubt if the title *science* should be applied to any knowledge as such, but should not rather be reserved for the *process which makes knowledge*. »

In general Dr. SINGER's sketch is so dependable that one or two slips or questionable statements should be pointed out. It is unlikely that « The student of an earlier time » (than the xth century) « could find no effective Christian teacher of literary Arabic » (p. 125), since a ixth century ecclesiast was shocked by the way in which Spanish Christians studied Arabic and neglected Latin literature. The usual complete Latin translation of the pseudo-Aristotelian *Secret of Secrets* was by PHILIP OF TRIPOLI; JOHN OF SPAIN (p. 127) seems to have translated only the medical portion. The quotation from AMBROSE (p. 130-131) is scarcely a fair sample of the total attitude toward natural science of the *Hexaemeron* of BASIL from which AMBROSE copied the statement in question. BARTHOLOMEW (p. 139) should be ANGLICUS, not DE GLANVIL who lived centuries later, and the fixed date in the career of BARTHOLOMEW of England is 1230, not 1260. WITelo (p. 140-141) is scarcely « the earliest » of the group of scientists mentioned, and he should be dated c. 1270 rather than c. 1250, since his *Perspectiva* is dedicated to WILLIAM OF MOERBEKE, penitentiary to Pope CLEMENT IV, later archbishop of Corinth, and whose translations date from 1268 to 1281 or later. At p. 112 Dr. SINGER, and again at p. 149 Rev. PERCY DEARMER continue to associate the date 1453 with the spread of Greek letters to the west, regardless of the warning sounded by Professor HEARNshaw at p. 37.

None the less, it is Rev. PERCY DEARMER's lecture on Art that has especially filled me with joy and gladness, and I wish that every modern might read it. And every reader should have his own copy, because he will probably be irresistibly stirred, as I was, to underline passage after passage — for instance, « if PERICLES had worn a top-hat and spats, where would PHEIDIAS have been? » — and even if he has no scruples against defacing the copy belonging to a library or to a friend, he will probably find that in any alien copy someone else has already done the underlining.

LYNN THORNDIKE.

(Cleveland. O.)

Sir **T. Clifford Allbutt**. *Greek medicine in Rome*. The FITZPATRICK Lectures on the History of Medicine delivered at the Royal College of Physicians of London in 1909-1910 with other historical essays, in 8vo., xiv+580+53 p. MACMILLAN & Co, London, 1921.

The FITZPATRICK lectures proper occupy 388 pages of this notable volume; supplement this number with the congruous matter contained in the author's essays on Byzantine Medicine, Public Health service and Salerno (in which the fading traditions of Greek and neo-Latin medicine are linked up with the Middle Ages) and we have a total of 474 pages bearing upon the propagation and development of Greek medicine in Rome. Breadth and subtlety of scholarship is impressed on every page of this new contribution from the Regius of Physic at Cambridge. As style is habitual with a man, we need not dwell on the sustained charm and allusive grace of presentation. There is a dynamic prepotency in his faculty for compressed statement that places him apart -- apart from other medical historians -- in a kind of perpetual felicity. Sir CLIFFORD has that skill in phrasing that often involves one in perilous departures from the usages of speech to which average mankind is very properly restricted; and he holds this gift without any countervailing rhetorical flaw. Flawless too, is the manner in which his historic background is laid in, -- the racial and cultural elements of primitive Rome. Rome is the vast dark background against which he projects the processions and conflicts of human ideas as they gather¹ from east to west. The predilection of the author for « denationalized origins » of medical theory, « the pure form and growth of medical thought » irrespective of nations and tongues, is early manifested and gives rise to rich and varied reconstructions. He holds himself free to make large digressions in space and time, so as to link up the chains of thought from generation to generation. This is what BULLINGS describes as obtaining a « parallax in time ». The only untoward result of this is an agonizing giddiness, a labyrinthine vertigo, which soon passes away.

Rational procedure in medicine was in no sense the creation of Rome, but came, with the settlement of Greek physicians in Rome and the Roman colonies, as « a superfetation upon, not an ingredient in, the national character ». Rome was but the arena whereon Greek met Greek in a furious and fateful conflict of ideas. And shrewd brushes they were, by the Rood! With what clamor, gusts of passion, shifts of fortune, this conflict went on, we may read in GALEN. But to understand just why the rising medical sects at Rome, like infinitely repellent particles, went slithering away from one another on slight differences of doctrine it is necessary to retrace « long and broken ways of history ».

Ionian elements constitute such a large part of the total content of Greek medical theory that we must survey with minutest care the physical and physiological inquiries of the Ionian nature philosophers and of the Italo-Sicilian schools. Remote in time as these considerations are, the author repeatedly warns us that without them the doctrines of the Greek physicians in Rome, of the Methodists and Pneumatics for example, cannot be comprehended. Sir CLIFFORD's rehearsal of the ancient and several philosophical syntheses, « the cosmogonies of those brilliant children, the Ionians », is eloquent but difficult; for the elder Ionians became « twice infants, rocked in the cradle of speculation » and their speech was gnomic and oracular. We have less difficulty in keeping our bearings among the Italo-Sicilian factions, but even here, the veiled, cryptic, half-symbolic guesses as to the nature of the atom and the mystery of motion tease us out of mind, elude our pains. They will not readily be drawn out in lucid categories of precision and reveal their worth to medicine. Ancient philosophical thought is of sovereign importance for later biological history — those who undo the corded bales find splendid stuff. There were dissections done in Ionia and Southern Italy, auguring good physical physiology. Ionian seers perceived the key to living processes to be a mode of combustion.

PYTHAGORAS, ALCMAEON, EMPEDOCLES, DIOGENES OF APOLLONIA form a Cyclopean group between whom and ourselves Sir CLIFFORD removes the awful distance. Entertaining their theories however carries the peril that comes from conjuring spirits; PYTHAGORAS redivivus will visit some mischief upon any author who does not give him instant employment, for he is known of old to have committed weird rogueries.

Passing to the chief medical protagonists in Rome, it must now be clear that time can neither dissipate the « heat at the centre », nor abate the volume of vital energy, in such men as ASCLEPIADES, THEMISON, CELSUS, SORANUS, ARCHIGENES, RUFUS and GALEN. Here were genuine colossi, dominating, achieving, through resistless intelligence. These figures are drawn in full length-drawn with the pencil of INGRES, be it added. The imperishable meaning of their work, the social significance of their lives, break down all the reticences which the ages would interpose. An intensely vivid human drama was that which enframed the adventurous Greek practitioners in Rome. Mark also, by the controversies raging along such bitter courses, that this will be accounted one of the greatest burgeoning periods in the history of the human mind. The degree of insight, the amount of scholarship, seasoned but unincrustated, which Sir CLIFFORD brings into play in the imperial period is nothing short of amazing. He styles himself a child in scholarship — what then, is a grown man in

England? His thrice-expressed fear that he has « failed to bring the Greek physicians in Rome out of chronological tables and to present them in living portraiture », awakes no echo in the charmed mind of the reader. In summarizing he says : « I have made a fair endeavour to illustrate the inner movements, and to read the genius, of those variously gifted races of whom Roman medicine was engendered — the dreamy Sicilian, the positive and sagacious Greek, the subtle and demonic Oriental — which, blended in Sicily and Alexandria, inspired the motley players who walked the stage of our art and mystery at the feet of the imperious mistress of the world ».

We are very grateful to the author for the inclusion in this volume, of his essays on « The rise of the experimental method at Oxford », « Medicine in 1800 », « Medicine in the xxth Century », and his delightful paper, reprinted from the Proceedings of the British Academy, on « PALISSY, BACON, and the Revival of Natural Science »

(Boston.)

EDW. C. STREETER.

Ludwig Choulant (Dresden, 1791-1861). *History and bibliography of anatomic illustration in its relation to anatomic science and the graphic arts*. Translated and edited with notes and a biography by MORTIMER FRANK (1874-1919), xxvii + 435 p. The University of Chicago Press, Chicago, 1920. [10 Dol.]

CHOULANT'S *Geschichte und Bibliographie der anatomischen Abbildung* (Leipzig 1852) has long been a classic, and if the readers of *Isis* were exclusively historians of medicine it would be superfluous to underline its importance. As many readers, however, are not physicians, nor anatomists, it is well to say a few words of the original work before introducing to them this excellent translation. CHOULANT was a very industrious Dresden physician, who found time to publish many important historical works, chiefly his *Handbuch der Bücherkunde für die ältere Medizin*, 1828 (new ed., 1842; anastatic reproduction 1911) and the *Geschichte* now under consideration. Both works are learned and carefully made compilations, the value of which is certainly great; but to call their diligent author a « great man », even to place him on the same level as LITTRÉ, DAREMBERG and HAESER, is one of these exaggerations into which biographers are but too likely to fall.

The aim of CHOULANT'S *Geschichte* was to study the development of anatomic illustration from two points of view : (1) the aid rendered to anatomic science by the graphic arts; (2) the aid rendered to the graphic arts by anatomic science. The results of his long researches

were offered in the form of a series of monographs of anatomists (MONDINO, MARC ANTONIO DELLA TORRE, MAGNUS HUNDT, VESALIUS, etc., and artists (LEONARDO DA VINCI, MICHELANGELO, etc.), with abundant and precise bibliographies, — the whole being preceded by a short historical introduction. The history of anatomic iconography is divided by CHOULANT into six periods: (1) prior to BERENGARIUS DA CARPI (1521; (2) from BERENGARIUS to VESALIUS (1521-1543); (3) from VESALIUS to CASSERIUS (1543-1627); (4) from CASSERIUS to ALBINUS (1627-1737); (5) from ALBINUS to SOEMMERING (1737-1770); 6) after SOEMMERING.

To come to the translation. The late Dr. MORTIMER FRANK, realizing the importance of CHOULANT's investigations, but keenly aware of the many additions which have been made to our knowledge since 1852, undertook in 1916 the compilation of a revised translation. The main additions are due to the wonderful activity of KARL SUDHOFF, and they alone would have given to FRANK's translation the value of a new book; — but as his task grew, the translator became more ambitious and gradually enriched CHOULANT's work with a large amount of complementary information inserted either in the text or in the footnotes.

Aside from the Introduction, the chapters not devoted to single individuals (these are too numerous to be quoted) are the following. Anatomic illustration of antiquity and of the middle ages; Manuscript illustration of the pre-Vesalian period (by FRANK, summarizing SUDHOFF's investigations): Drawings showing influence of tradition upon early illustration. The Provençal-Basel skeleton and other graphic skeletal representations of the middle ages. MS. diagrams of the *foetus in utero* and their origin from MSS. by SORANUS (by the way, this evolution is remarkably free from oriental influence, the tradition of obstetric drawings going back directly to antiquity without the mediation of the Arabs). Schematic drawing of the eye. Schemata of male viscera in bloodletting manikins of the xvth cent. Schemata of the female viscera *in situ* c. 1400-1543. (all this is splendidly illustrated) — Fugitive sheets with pro-Vesalian anatomy (p. 156-167) — Turkish anatomy (p. 330; apropos of an anatomy published in Scutari 1815 by the Ulema SCHANI ZADEH) — Works on artistic anatomy (p. 351-361; a list completing the bibliographic information given in previous sections).

As if this revised edition were not in itself a sufficient gift, the editors have added to it a series of appendixes: The life of JOH. LUD. CHOULANT by FRANK, including a bibliography — A memorial notice of MORTIMER FRANK by F.-H. GARRISON — Chinese anatomy by CHOULANT (from *Illustr.-med. Ztg.*, t, 3, p. 211-216, München 1853) — Sculpture and painting as modes of anatomical expression by F.-H. GARRISON and Edw. C. STREETER. — Anatomical illustration since the time of

CHOULANT by F.-H. GARRISON (a critical bibliography with brief preface).

The way in which this excellent book is got up is a credit to the University of Chicago Press.

G. S.

G. Bohn. — *Le mouvement biologique en Europe*, 144 p. (185 x 120).
Paris, A. COLIN, 1921. [4 Fr.]

Chargé par le ministère de l'instruction publique, en 1913, de visiter en Autriche-Hongrie, en Russie et en Allemagne, les centres les plus actifs des recherches biologiques, G. BOHN vient de publier les réflexions suscitées en lui par son passage dans les laboratoires de Strasbourg, Heidelberg, Wurtzbourg, Munich, Vienne, Cracovie, Moscou, Saint-Petersbourg et Berlin.

Les savants allemands, trop spécialisés, et les splendides laboratoires qu'ils dirigent, lui ont semblé, somme toute, fort peu intéressants, à l'inverse de l'impression qu'il a reçue en Pologne et en Russie, et de celle qu'il ressent en France, en présence de BATAILLON, de FR. HOUSSAY, et de... lui même. Et il pense, avec juste raison d'ailleurs, que « la production scientifique d'un peuple est étroitement liée à sa mentalité sociale ». Si la science allemande lui semble en décadence, — un des symptômes les plus nets de ce fait étant représenté par le succès des théories néo-vitalistes en Allemagne, des théories de DRIESCH — c'est qu'elle est trop spécialisée, trop organisée. « Si la discipline renforce l'esprit de logique, elle tue au contraire l'esprit d'invention ». L'idée est intéressante, mais elle est insuffisamment développée.

On trouve d'ailleurs dans ce livre trop de choses qui n'ont, à tout prendre, qu'un lien fort éloigné avec le mouvement biologique en Europe. En dehors des descriptions de certaines expériences de PRIZBRAM, KAMMERER et autres, à l'Institut de biologie expérimentale de Vienne, sur la régénération, ou l'action des divers facteurs du milieu extérieur sur l'évolution des organismes, de celles de PAVLOV et de ses élèves, dans les trois laboratoires qu'il dirige à Saint-Petersbourg, sur les phénomènes cérébraux, de quelques autres travaux qui ne sont guère qu'indiqués, et d'un chapitre où l'auteur cherche à montrer que l'étude de l'hérédité, qui accapare actuellement le plus grand nombre des biologistes, doit céder le pas à celle de la morphogénèse, on trouve une longue description, d'après SIEDLECKI (Cracovie), du fameux jardin botanique de Buitenzorg, un chapitre (p. 35-45) sur le socialisme de KARL MARX, opposé à l'individualisme, la discussion de cette opinion de MAZARYK que « la jeunesse est conservatrice parce qu'elle n'a pas d'expérience », etc.

Au reste, il est difficile de savoir à quels lecteurs l'ouvrage est destiné; parlant d'animaux ovipares et vivipares, l'auteur croit nécessaire de définir ces qualificatifs, tandis qu'il est question ailleurs, sans explication, de la pariétale ascendante, des tropismes, de paranoïques,... termes dont le sens est cependant beaucoup moins généralement connu que celui des précédents.

L. GUINET.

Ernst v. Meyer, *Professor der Chemie an der Technischen Hochschule in Dresden*. Geschichte der Chemie von den ältesten Zeiten bis zur Gegenwart, zugleich Einführung in das Studium der Chemie. Vierte Auflage. XIV + 616 S. in 8°. Leipzig, VEIT & Co, 1914

Schon die erste Auflage dieses Buches (1888) hatte eine Lücke in der deutschen wissenschaftlichen Literatur auszufüllen, denn seit dem Erscheinen von KOPPS klassischem Werke waren mehr als vierzig Jahre verflossen. Seither ist das Buch als standard work der chemischen Geschichtsschreibung stets unentbehrlicher geworden. Die vierte, im Vergleich mit der dritten wieder stark angewachsene Auflage bietet in mehreren Richtungen grosses Interesse. Es werden daraus die Fortschritte der chemisch-historischen Forschung sowie der Chemie selbst in der etwa zehnjährigen Zeit seit dem Erscheinen der dritten Auflage augenscheinlich. Die Hauptpunkte in ersterer Hinsicht seien hervorgehoben.

Ueber die Chemie der Aegypter hat der Papyrus von Leyden und jener von Stockholm wertvolle Aufschlüsse gegeben. Sie besaßen erstaunliche Kenntnisse über Metalllegierungen, Edelsteinfälschungen und Farbstoffe. Hingegen hat WIEDEMANN nachgewiesen, dass die chemischen Kenntnisse der Araber früher überschätzt wurden. Die Ergebnisse BERTHELOTS auf gleichem Gebiete bedürfen nach den Arbeiten von LIPPMANN und DIELS' einiger Einschränkungen. JOACHIM JUNGIUS wird als Vorläufer BOYLES warm gewürdigt. Desgleichen, auf Grund von Forschungen MENSCHUTKINS, der russische Forscher M. W. LOMONOSSOW (1711 bis 1765) als Vorläufer LAVOISIERS und frühzeitiger Verfechter der Atomenlehre, der kinetischen Wärmetheorie und der Energieerhaltung. Ueber die Aufstellung der Atomenlehre durch DALTON hat A. N. MELDRUM in Manchester 1910 und 1911 wertvolle neue Ergebnisse veröffentlicht. Die Kenntnis AVOGADROS und der Geschichte seiner Theorien wurde durch GUARESCHI wesentlich gefördert. Die Geschichte der organischen Chemie hat eine Bereicherung erfahren, indem ANSCHUTZ ein merkwürdiges Werk des österreichischen Physikers JOSEF LOSCHMIDT aus dem Jahre 1861 entdeckte und neu herausgab (OSTWALDS *Klassiker* Nr. 190), in welchem dieser Forscher als Vorläufer KEKULÉS in der Benzoltheorie und als früher Vertreter der graphischen Darstel-

lung chemischer Formeln erscheint. Grössere Aenderungen erfuhren ferner die Kapitel über Energetik, chemisches Gleichgewicht, über die Erfindung des Rückflusskühlers und des Wasserbades, über die Entstehung des Petroleums, über Gährungserreger und Fäulnis, über die Erfindung des Porzellans, über Photographie, Kautschuck, über Universitätslaboratorien. Eine Reihe kurzer Biographien bedeutender Männer wurden neu eingefügt.

ERNST v. MEYER ist am 11. April 1916 im Alter von 69 Jahren gestorben. Seine grossen Verdienste um die Geschichte der Chemie sind um so bemerkenswerter, als er bei dem Fehlen eines chemie-geschichtlichen Lehrstuhles in Deutschland diese Tätigkeit nebenamtlich verrichten musste. Vielleicht wurde ihm der Anstoss dazu durch den Umstand gegeben, dass er als einer der letzten, treuen Anhänger H. KOLBES noch in den Achtzigerjahren die chemische Strukturtheorie ablehnte und dann doch den neuen Anschauungen Raum geben musste. Seine Publikationen zeichnen sich durch den weiten Blick des Historikers aus, so die chemischen Teile des bei TEUBNER erschienenen encyklopädischen Werkes *Die Kultur der Gegenwart*, die von ihm redigiert wurden und eine längere, geschichtliche Einleitung aus seiner Feder enthalten.

(Brünn, Mähren.)

ERNST BLOCH.

Carl Graebe. *Geschichte der Organischen Chemie.* Erster Band, x + 416 S. Berlin, JULIUS SPRENGER, 1920.

Here we have an intimate and delightful account of the development of Organic Chemistry during its first one hundred years — an account written by one who has figured as the prime mover in some of the spectacular advances of this subject and in close touch with all. In his preface Dr GRAEBE tells us that an interest in the historical side of chemistry has pursued him ever since his university days and that ever it has been his desire to produce a book which should supplement the ordinary text books by supplying the human factor, the steps by which the present theories of Organic Chemistry from earliest times have advanced to the point where now we may express our conceptions in established space —, or structural — formulas. The present book is evidently the fruit of years of contemplation on chemical processes from the historical standpoint; and comes after a life so filled with the details of the lecture and laboratory that now for the first time this History of Organic Chemistry has become possible.

The book begins with the work of SCHEELÉ on vegetable and animal chemistry from the pharmaceutical standpoint and with the reform established by LAVOISIER (which affected organic as well as inorganic

chemistry) and continues thru the nineteenth century nearly to the end, to FISCHER'S work on phenylhydrazine and the recent theory of the arrangement of atoms in space. The second volume will be left to younger hands and will continue the story from about 1890 up to the present time. This latter volume, which will appear in about two years, is now being elaborated in the hands of Professor Dr. KURT HOESCH.

In order to show how in the passage of time the subject of Organic Chemistry has been developed, the present book is divided into time-sections and each such section deals with the separate investigations of the period. In this way a general picture is developed — a kind of moving picture — of the gradually changing points of view which were fruitful in the progressive development of the subject as a theoretical and experimental science.

In each period there are given short notices of the lives of eminent chemists with abstracts or references to commemorative addresses. This gives an added human interest which will be especially acceptable to those many Americans whose early education was laid in the European universities, so that they were brought into touch with these great leaders.

The *first time-section* in three chapters deals with the period from 1770 to 1810 when organic chemists were to be found almost wholly in pharmaceutical or medical lines. We learn that in SCHEELE'S time only four organic acids had been prepared: acetic and formic by distillation and benzoic and succinic by sublimation. (Salts of oxalic and tartaric acids were known, but not the free acids.) Alcohol had been distilled and converted into ether and other products. Also, Berlin blue and potassium ferrocyanide had been prepared. But in chapter I, after a short notice of SCHEELE'S life, it is shown that an original systematic method was developed by this versatile worker, by which he was able in a short time to add eight organic acids, as well as hydrocyanic acid, to the list. He developed also a method of attack upon the esters, thus laying the foundation for our present methods of saponification and the preparation of both « base » and « acid » from these « ethereal salts ». It is to be remembered also that SCHEELE was the first to prepare that important compound glycerine.

LAVOISIER'S life follows in chapter II, together with the application of his oxygen theory of bases and radicles to organic chemistry, which brought into this previously forbidding realm a new conception of compounds and the possibility of their quantitative examination. By the oxygen theory, tho it is known more prominently thru its application to the inorganic field, investigators in organic chemistry felt themselves for the first time invited to their labor rather than repelled

from a great and seemingly unwieldy mass of the animal and plant products.

The qualitative developments, following SCHEELE, rather than the slower quantitative methods of LAVOISIER, filled the rest of this period as described in chapter III. FOURCROY and VAUQUELIN continued successfully the preparation of organic acids; and other contributions followed which were necessarily of minor importance, for attention at this time was focussed upon the great discoveries in inorganic chemistry with which we connect the names of BERTHOLLET, PROUST, KLAPROTH, DAVY, DALTON, GAY-LUSSAC and THÉNARD. We remember also that in 1810 and 1811 appeared the memorable contributions of BERZELIUS and AVOGADRO.

The *second time-period*, from 1810 to 1820, is covered by Chapters IV to VI inclusive. Here are described the first elementary organic analysis, with details of the contributions and methods of GAY-LUSSAC and THÉNARD, of BERZELIUS and then of LIEBIG; the researches on cyanogen, on the composition of alcohol and ether, on starch and sugars; CHEVREUL's well known work on fats with methods by which pure products could be obtained from natural substances. It was CHEVREUL who anticipated the artificial preparation of urea by a year or two by refusing to ascribe any function to the mythical « vital force ». At this time came the first researches on the alkaloids and on the oxidation of alcohol to aldehyde and then to acetic acid; and FARADAY's preparation of halogen substitution products and of β -naphthalene sulphonie acid.

The *third period* includes the progress of discovery from 1820 to 1840. « Important new theoretical developments were established on an experimental basis, like the recognition of isomers and the founding of the first constitutional formulas. Many new interesting compounds were discovered; and the synthesis of organic preparations started on its first development. » In this work, besides GAY-LUSSAC, BERZELIUS and MITSCHERLICH, stand out preeminently the names of DUMAS, WÖHLER and LIEBIG.

The time periods now follow the decades :

Fourth period, 1840-1850, in which the work of the great chemists, already mentioned, ended; and the work was continued by younger men — especially LAURENT and GERHARDT, HOFMANN, FRANKLAND, KOLBE and PASTEUR.

Fifth period, 1850 to 1860. This is the decade which includes the new type-theory and the new radicle-theory, the labors of WILLIAMSON, BERTHELOT and KEKULÉ, with CANIZZARO and the acceptance of the theory of AVOGADRO.

Sixth period, 1860 to 1870, including the establishment of atomic weights, graphic formulas and structural formulas.

Seventh period, 1870 to 1880. Here we have very well told the dramatic story of KEKULÉ's conception of the benzene formula (1865) and its experimental verification; the variations of this formula due to CLAUS (1867) and to LADENBURG (1869); the objections to KEKULÉ's formula of BRUHL and JULIUS THOMSEN; the centric formula of ARM-STRONG-BAEYER; and the swing of preference back and forward from 1870 to 1890 between the KEKULÉ, the prism and the centric formulas; and the lack of agreement upon either one. Finally come the wonderful stories of indigo and quinone, and the constitution of naphthalene and alizarene, with which the author's name will be ever associated.

Eighth period and last, 1880 to 1890. In this decade is included an account of triphenylmethane and the azo-dyes, of researches on perfumes and lastly the « Lagerung der atome in Raum » — the arrangement of atoms in space; so that the whole long story ends with about the year 1890.

Thus we have a fascinating account of perhaps the greatest progress made in any single department of science and that too in a century in which the advances in all departments of science crowd upon each other — a story well told by one who has an easy command of language. The text is filled with quotations and references to the original articles. Moreover the interlarding of the text with the stories of the lives of the most noteworthy contributors to the advancement of the science is a pleasing device, relieving the account of any possible leaning towards monotony. To divide an historical account absolutely into decade periods is of course impossible but the author seems to gain easily the advantage of this *aide-mémoire* by judicious contributions of foresight and review, thus locking the story into a complete whole.

As one finds readily at hand histories of the time preceding his own activity but obtains with more difficulty an accepted account, with the proper perspective, of very recent years, so the reviewer whose work began in 1890 reads with the keenest pleasure this new contribution to the History of Chemistry, as presented in volume I, by Dr. GRAEBE, yet looks forward with an interest touched perhaps with some anxiety, to the appearance of the more difficult summary of the thirty recent years, as promised from the pen of Dr. HOESCH.

In so excellent a book, which is supposed to cover the world-advances in organic chemistry, it would seem proper to inquire if there were no noteworthy contributions in America until after 1890. No mention is made of REMSEN and his collaborators, of the work on the sulphonic acids and the discovery of saccharine, the founding of the *American Chemical Journal* or of the rather extensive work on American petroleums.

Germany may well be proud of her record in organic chemistry. This science begun by SCHEELE and BERZELIUS in Sweden, clarified by the theory of LAVOISIER in France, owes nearly all its development to the labors and clear insight of the German. The aniline dye industry, starting in England, found its almost complete development in the German laboratories. Possibly, nine tenths of the history of organic chemistry is frankly German. Remembering this, it seems eminently proper and fitting that we should look to that country for a sympathetic and inspiring history of this science, such as has now come to hand as a monument to that CARL GRAEBE of Frankfort who, among other discoveries, established the constitution of anthracene and gave us what afterward developed into the quinoid color-theory.

(Amherst College.)

ARTHUR JOHN HOPKINS.

Markham, Sir Clements R. (1830-1916). *The Lands of Silence*. A history of Arctic and Antarctic exploration, xii + 539 p., with many maps and illustrations. Cambridge, University Press, 1921.

This posthumous volume edited by the care of F. H. H. GUILLEMARD is the worthy termination of an admirable career (for which see, for example, the *Encyclop. Brit.*, 11th ed.). Many of Sir CLEMENTS' numerous publications are of interest to the historian of science; one of them, his translation of GARCIA DA ORTA's *Colloquies* was reviewed in *Isis* by Mrs. A. Arber (t. II, 415). He was very well prepared to write a history of polar exploration, not only by his lifelong studies in the history of geography, but even more because he himself was a member of the first FRANKLIN search expedition in 1850-1851 and because, as president of the Royal geographical society, he was the chief organizer of the national Antarctic expedition under Captain ROBERT SCOTT in 1901-1904.

To appreciate fairly this history, it is necessary to bear in mind that the author's aim was *not* to write a history of scientific exploration or of the progress of polar knowledge, but rather a history of these expeditions from the seaman's point of view. In other words, he is more interested in the heroic aspect of polar discovery than in its scientific implications. If we admit that, it is not altogether fair, as has been done by another reviewer (1), to reproach the author for having given so little importance to scientific research. We must state, of course, that his history is not complete, but what Sir CLEMENTS proposed to do, he did very well. He explains his point of view on p. 174. when,

(1) HUGH ROBERT MILL, in *Nature*, vol. 107, p. 291; a careful review.

after having mentioned the presence of NELSON as a midshipman on board the *Carcass* (PHIPP's expedition of 1773 to the Greenland sea, reaching the latitude of 80° 50'N.), he remarks: « The future hero thus gained his first naval experience in the Arctic regions, as other naval heroes of lesser fame have done before and since his time... It is this phase of exploration that has the highest importance. Great as are the commercial advantages derived from Arctic discovery, and still greater as are its scientific results, the most important of all are its uses as a nursery for our seamen, as a school for our future NELSONS, and as affording the best opportunities for distinction to young naval officers in time of peace ». Sir CLEMENTS' account is very methodical, accurate and its simplicity does not detract anything from the grandeur of the deeds recorded, on the contrary.

The book is divided into two main parts: Part I, by far the longest (386 p.), dealing with the Arctic regions; part II, with the Antarctic regions. The second part is much shorter because the second history began much later. While the first expedition to the North dates back to 1553 (WILLOUGHBY and CHANCELLOR), the first expedition to the South did not occur until more than two centuries later, in 1772-1775 (COOK): the Antarctic circle was crossed for the first time in the history of civilized man by Captain Cook on the 17th of January 1773, in 39° 35' E. The scientific aspect is not entirely neglected, for each part begins with introductory chapters explaining the problems that were to be solved and ends by a conclusion setting forth those the solution of which has not yet been attained. There is also a short chapter (p. 426-429) devoted to Antarctic oceanography. Still the scientific history of polar expedition remains to be written; Sir CLEMENTS' narrative provides the human background of it, — a background in this case of heroic proportion.

I should mention that Sir CLEMENTS' book contains (p. 57) a list of astrolabes treasured in English collections. He gives a sympathetic account of HAKLUYT, remarking incidentally (p. 119) that his first book, the *Divers Voyages touching the Discoveries of America*, 1582, was the first impetus to colonization. « Virtually, RALEIGH and HAKLUYT were the founders of those colonies which eventually formed the United States ». SCOTT's two expeditions are very soberly but very effectively described and one can but subscribe to his final judgment (p. 504): « In the whole range of polar history there is no greater name than that of ROBERT FALCON SCOTT. A life of devotion to duty, latterly of devotion to scientific discovery, was closed by a heroic and glorious death. A man with rare gifts both of head and heart; those gifts were nobly used through life, and were never more prominent than in his last fatal march and in the hour of death. » — But indeed the

whole history of polar expedition is an unparalleled tale of endurance and heroism.

The book is completed by a bibliography and a chronology of polar voyages. The illustrations are numerous but we would have welcomed more portraits of the great explorers.

G. SARTON.

William A. Mason. *A History of the Art of Writing.* 502 p. New York, MACMILLAN, 1920.

Mr. MASON in undertaking a comprehensive work in a field thronged with experts has shown a courage not inferior to that of H. G. WELLS. It is much more than a history of the alphabet. It attempts to trace the evolution, from primitive picture writing, of our present-day phonetic characters. The effort is certain to be severely and copiously criticized, but, on the whole, the volume — generously illustrated — is a readable and illuminating work, of which the author and the publisher have a right to be proud.

The contents bear witness to years of investigation and collection of data carried on with the enthusiasm of a real amateur. This zeal for the subject is supplemented by an exceptionally fine appreciation of artistic writing and printing. The author employs a simple and straightforward style, as free as his subject will admit from technical expressions. He is never dull, and appears to greatest advantage in the direct exposition of the facts gathered by his comprehensive studies. The generalizations are limited in number and marked by sobriety of judgment. The author has availed himself of the results of recent archeological research, and is careful to recognize that there are gaps in the story of our alphabet that are still to be made good. He supports the traditional view that the Greeks obtained their alphabet from the Phoenicians. Did the Phoenicians in turn derive their phonetic signs from the Cretans? That and many similar questions must, for their answer, await the results of further investigation.

In the opening chapter Mr. MASON shows the persistence in our present language of primitive elements, which, like rudimentary organs, afford a clue to the evolutionary process. Has development been arrested by the establishment of conventional standards? The story of progress told in this fascinating *History of the Art of Writing* should encourage the efforts of those who would press on to a phonetic system of writing and printing ideally economic and artistic.

It is one of the admirable features of the book that considerable space is given to the Peruvian knot-records, the picture writings of

the ancient Mexicans, those of the northern American Indians — on stone, wood, birchbark, hides, and other materials — as well as to the hieroglyphic writing of the South Sea Islanders. Subsequent chapters deal with the Chinese, the ancient Egyptians, the Babylonians and Assyrians, Hittites, Greeks, and Romans. The author exposes himself more than once to the censure of the student of hieroglyphic and cuneiform writing. Having undertaken to treat so wide a range of material he has been tempted to rely on the authority of certain scholars, whose work has at times been called in question. He follows, for example, a discredited system of chronology in the case both of Egypt and Babylonia. He seems even to confuse CYRUS with DARIUS (p. 226). Indeed, the book is in need of careful revision. It is too good in its general conception, in its spirit, and in its wealth of illustrations to go unrevised. The last three chapters deal with writing in the middle ages, European alphabets derived from the Greek, and the age of printing. The last chapter does not give a very lucid account of the invention and early history of printing. It is followed by a bibliography of seven pages.

WALTER LIBBY.

Th. Meyer Steineg und Kari Sudhoff. *Geschichte der Medizin im Ueberblick mit Abbildungen*, 444 S., 208 Abb. Jena, FISCHER, 1921.

This outline will prove highly interesting, not simply to the student and the educated physician for whom it was composed, but also to the experienced historian of medicine. For when two old masters like SUDHOFF and MEYER-STEINEG join hands in such an undertaking, we are extremely interested to find out the results of their selection: what did they finally decide to include and to omit? what were to their minds the essential points in the history of medicine? Such an outline should be consulted by the veteran historian for the sake of correcting, if needs be, his perspective. He will not refer to it for positive information, since the book was not made with that purpose in view. As the authors state in their preface, for the study of the concept of disease he should rather turn to ERNST SCHWALBE's *Leitfaden*; for historical detail to PAGEL's *Einführung* revised by SUDHOFF; for a comprehensive and philosophical treatment of the whole subject to MAX NEUBURGER's *Geschichte*; for monographs on special topics to THEOD. PUSCHMANN's *Handbuch*. To this list, I would like to add FIELDING H. GARRISON's *History* which contains a very complete, if brief, summary of modern medicine.

But the main interest of this outline lies in the abundant and well-chosen illustrations, most of which are based upon the original mate-

rial collected by SUDHOFF in his Institute at the University of Leipzig, and by MEYER-STEINER in his Museum at the University of Jena. The greatest part of these illustrations have already been published, chiefly by the authors themselves, but it is pleasant and stimulating to see them again following one another in orderly sequence.

The book is divided into three parts, SUDHOFF being responsible for the middle one and MEYER-STEINER for the two others : Part I. Primitive medicine. Medicine of the ancient east and of classical antiquity down to GALEN — Part II. The middle period from GALEN's death to BACON — Part III. Modern times from HARVEY down to our days. These three parts cover respectively 140, 159 and 125 pages, with 75, 83 and 50 illustrations ; that is, they are almost equal, somewhat greater importance being given to the middle one, and a somewhat smaller to the last one. This subdivision pleases me much, but it is, of course, open to criticism ; that is partly a matter of taste. The illustrations relative to recent times are but few, but the student will find many more, if he wish, in GARRISON's book above-mentioned.

The student of this subject could find no better introduction to it than SUDHOFF and MEYER-STEINER's book.

GEORGE SARTON.

Hübötter, Franz. *3000 Jahre Medizin.* Ein geschichtlicher Grundriss, umfassend die Zeit von HOMER bis zur Gegenwart unter besonderer Berücksichtigung der Zusammenhänge zwischen Medizin und Philosophie, 535 p. in-fº, illustr. Berlin, OSCAR ROTHACKER, 1920 (150 autographic copies).

The author delivered a course of lectures on the history of medicine at the University of Berlin in 1915 and the book under review is an outgrowth of these lectures. Dr. HÜBÖTTER's purpose is to give a readable account of the development of medicine from the heroic ages of Greece to our day. The development of the last century is of course simply sketched. A history of the special branches of medicine will appear later in the encyclopedic collection *Die Kultur der Gegenwart*. The treatment of Oriental medicine (except Islamic medicine) has been deliberately avoided because the author plans to come back to it after a long journey in Asia which he is now making and which will keep him busy for many years (when I last heard from Dr. HÜBÖTTER, he was in Japan). He declares that it is impossible to give a satisfactory account of Asiatic medicine before extensive investigations have been completed. This statement has the more weight in that Dr. HÜBÖTTER knows perhaps more of Chinese medicine than any other man. He has already published important contributions on this his favourite sub-

ject, and the study of Chinese medicine will probably engross the rest of his life.

To come back to the present work, Dr. HÜBOTTER has wisely concentrated the attention of his readers upon the main personalities. He has treated with special care the great medical systems of the xviii and xix centuries, analyzing each of them as objectively as possible. Upon the advice of one of his former teachers, Prof. F. KRAUS, he has given a particularly elaborate account of the development of the notion of irritability. Also, as is emphasized in the title, he has taken pains to show the interrelations between medicine and philosophy. It is interesting to note that according to the author the greatest heroes of medical history are: GALEN, AVICENNA, VESALIUS, PARÉ, HARVEY, HALLER, LISTER, VIRCHOW and KOCH (why is PASTEUR not included? By the way, the account of PASTEUR's work is very unsatisfactory, and CLAUDE BERNARD is not even quoted!) An excellent feature of this textbook is the inclusion of the original texts of the fundamental sources, with translations in the case of Greek fragments; what is even better, there are facsimile reproductions of many pages, for example of HARVEY's *de motu cordis et sanguinis*. The student is thus placed at once in the sacred presence of the greatest medical authors. Bibliographical information has been reduced to the essential, but Dr. HÜBOTTER refers his reader for more literature to HERMANN VIERORDT's handy *Medizin-geschichtliches Hilfsbuch* (Isis, III, 365).

We look forward to the results of Dr. HÜBOTTER's studies in Oriental medicine. May his investigations be successful! G. S.

Holländer, Eugen. *Die Karikatur und Satire in der Medizin.* Medikokunsthistorische Studie. Zweite Auflage, xvi + 404 S., Hoch-Quart., mit 11 farbigen Tafeln und 251 Abbildungen im Text. Stuttgart, FERDINAND ENKE, 1921.

Prof. Dr. HOLLÄNDER has been studying for many years the relations between art and medicine and collecting photographs of the works of art of medical interest. His books on these subjects have already become classical. They are: *Die Medizin in der klassischen Malerei*, 1903, second ed. 1913; *Plastik und Medizin*, 1912 and the book now under review, the first edition of which appeared in 1905. The new edition is not essentially different from the first one, though small changes and additions have been made here and there.

This study of Caricature and Satire in Medicine is subdivided as follows: Antiquity, Caricatures by Egyptians, Greeks and Romans. Satires by the Greeks (AESOPUS, ARISTOPHANES, PHILEMON, anthology); by the Romans (CATO, PLINY, MARTIALIS) and in the East (India, China,

Persia, Palestine). Middle Ages (chivalric and heroic songs, dance of death). Satire and caricature before, during and after the Reformation : JOHANN WEYER, PETRARCA, RABELAIS, ERASMUS, SEBASTIAN BRANDT, GEYLER, MURNER, MOSCHEROSCH, TILL EULENSPIEGEL, PAULUS SCHIMPF and ERNST, AGRIPPA VON NETTESHEIM, ULRICH VON HUTTEN, MONTAIGNE. xvth and xviii century : MOLIERE, his school and German imitators — Medical fees — Satire and caricature of pathology : RABELAIS, LEONARDO DA VINCI. gout, plague, syphilis, cholera, nervous diseases etc. — Caricature of medical methods and diagnosis etc. — Quacks — Medico-political caricature and satire — Modern medical caricature.

The illustrations are excellent though not always pleasant, and are mostly of German, English or French origin. Among the coloured plates I notice some by L. BOILLY, J. GILLRAY, J. ROWLANDSON. I would personally have preferred a chronological classification of the whole material, but I quite realize that many will like better the author's scheme.

G. S.

L. Lewin. *Die Gifte in der Weltgeschichte.* Toxikologische, allgemeinverständliche Untersuchungen der historischen Quellen, xvi+596 p. Berlin, SPRINGER, 1920.

This is a very elaborate study of the use of poisons from the earliest times to our own. LEWIN's investigations have been carried on in such a comprehensive and fastidious manner that his book might well be called an encyclopedia of historical toxicology. Such a subject may seem at first sight to be one of rather remote interest, but a moment of reflection will convince us to our deepest shame that it is singularly up-to-date. For poisons have been used at all times, but never on so gigantic a scale as during the latest war; and even now every « civilized » nation is keeping up a staff of chemists to discover new poisons or « improve » the old ones. The amount of poisons used during the war in the form of poisonous gases or liquids has been tremendous, and what rôle poisons will play in the next world war — if such ever breaks out — only the Devil knows.

To make a summary of such a book, which will be used as a reference book rather than read from cover to cover, is out of the question, and the best that I can do is to outline its contents.

(I) Development, diffusion and application of toxicological knowledge in ancient times : this includes such topics as the relation of poisons to magic, the use of love potions (*pocula amatoria*) and abortives, and the imaginary poisons, *ex. gr.* the alleged poisoning of wells by Jews or Christians, not to mention of course the broader subject

implied in the title, the history of toxicological knowledge in antiquity.

(II) Poisonings from the pathological viewpoint : poisonings which simulate diseases ; mental disorders caused by poisons ; stupefaction of condemned witches ; diagnosis of poisoning, etc. (every topic is treated historically).

(III) Toxicological therapeutics in ancient times : antidotes ; alexipharmaka ; emetics.

(IV) Laws concerning poisoning : Greek, Roman, Jewish, canonic, Germanic laws. Use of poisons by the state for punishment (hemlock, p. 65-72 ; snake venoms ; etc.).

(V) Poisonings by means of drugs : accidental and intentional poisonings by physicians ; how they were dealt with in ancient times ; poisonings by narcotics ; accusations of Jewish physicians as poisoners ; poisonings caused by defective posology.

(VI) Poisonings caused by indirect means : *ex. gr.* by means of perfumes or of scented flowers and letters ; by means of gloves, wigs or undergarments. Poisoning of wounds and of the membranes (ear, nose, rectum, vagina). Poisoned nails and weapons. Inhalation of poisons.

(VII) Suicide by poisoning : p. 121-156.

(VIII) Antiquity and signification of arsenical compounds as poisons : the first chapter tells the story down to the xivth century.

(IX) Prominent men who were the perpetrators or victims of poisonings : Greece, Palestine, Rome (the case of ALEXANDER takes 11 pages!). — MOHAMMED ; the Assassins ; the time of the Crusades. — Germany from the xiiith to the xvth cent. — France, Burgundy, Netherlands, England, Spain, Portugal, Russia during the same period. — Italy in the xivth and xvth. — Poisonings in the xvth cent. and later.

(X) Poisonings perpetrated by women : Down to the xvth cent. The Renaissance in Italy and France. France under LOUIS XIV, and South Italy.

(XI) Priests who were the authors or victims of poisonings : the Emperor HEINRICH VII. — Poisonings of popes and princes of the church — ALEXANDER VI and CÆSAR BORGIA. — Poisonings of popes in the xvth and xviiith cent.

(XII) Poisons in warfare : Secret introduction of poisons into the enemy's camp or country. — Poisoned arrows. — Military use of venomous animals. — Poisoned projectiles and gases.

The author's allusions to the great war are very discreet ; he has not written this book with any aggressive bias or any purpose other than the purely historical one. The sources are duly given and, when suffi-

ciently brief, the relevant passages are quoted in the footnotes and translated in the text. The plan adopted by L. LEWIN has entailed frequent repetitions and not a few artificial combinations. I believe a purely chronological order would have been on the whole more satisfactory, though the author's plan has certainly some advantages. My main objection however is that the immense amount of material collected by him has not been sufficiently digested; his book gives one too much the impression of being a compilation by mere juxtaposition, rather than an organic and harmonious synthesis. At any rate it will be very useful, and for every topic, smacking however little, of poison; the historian will do well to refer to it.

GEORGE SARTON.

John Bagnell Bury. *The Idea of Progress.* An inquiry into its origin and growth, xv+377 p. London, MACMILLAN, 1920.

J. B. BURY, regius professor of modern history in the university of Cambridge, to whom we owe already, among other works, the standard edition of GIBBON and an excellent *History of the Freedom of Thought*, has made us a new gift, not less precious nor welcome than his previous ones. His new investigation is of fundamental importance to the historian of science, — for it is safe to assume that the latter's activity is largely impelled by his belief in progress, at the very least in scientific progress. What makes our studies so fascinating and so inspiring is the fact, which we take for granted, that science is essentially a cumulative process, and not simply a progress but an accelerated progress (1).

The idea of progress dominates modern thought to such an extent, that it takes some effort of imagination to realize its relative youth; it is not yet two hundred years old! What is the idea of progress? it means « that civilization has moved, is moving and will move in a desirable direction ». This definition evidences at once the metaphysical or adventurous character of this idea. Admitting that we can prove the reality of progress in the past and present, we can not prove its indefinite continuance in the future, nor can we prove that humanity will move forever in a desirable direction. Hence belief in progress is an act of faith, but we might as well accept at once the fact

(1) For a previous investigation on the idea of progress, a collective investigation which took place in Rome 1912, see *Isis*, II, 245. — An elaborate history was published in 1910 by JULES DELVAILLE, *Histoire de l'idée de progrès jusqu'à la fin du XVIII^e siècle*, 773 p. Paris, ALCAN. I have ventilated my own thoughts on the subject apropos of RADL, « Geschichte der biologischen Theorien », in *Isis*, II, 226-227.

that inasmuch as the future is unknown, man can not live without faith. His very activity implies some sort of faith. The assumption of progress belongs to the same order of ideas as the belief in Providence or personal immortality. Yet there is a great difference which will be sufficiently illustrated by the fact that the development of the idea of progress is intimately connected with the growth of modern science, the growth of rationalism and the struggle for political and religious liberty.

It is very curious that the Greeks, even the wisest of them, never hit on the idea of progress: their historical experience was far too small, and they were trammelled by their theories of Moira, of degeneration and cycles and their intellectual conservatism. The only ancient writer to conceive this idea, as restricted to scientific progress, was SENECA, who said, « One day our posterity will marvel at our ignorance of causes so clear to them », (1) a magnificent sentence which every scientist should always keep in mind. The spirit of the Middle Ages was not less incompatible with the birth of this idea, for their exclusive and narrow conception of Providence and their apocalyptic dreams were absolutely opposed to it. It is only with the Renaissance, when self-confidence had been restored to human reason, that the idea could germinate, though at the beginning the authority justly ascribed to the ancient writers was so overwhelming that the little seedling could grow but very slowly. It was not until COPERNICUS, VESALIUS and others had crushed this superstitious reverence that its existence was assured. The first to grasp the idea were GUILLAUME POSTEL, 1541 and JEAN BODIN, 1566. BODIN asserted the principle of the permanent and undiminishing capacities of nature; he claimed that the world had not degenerated since ancient times; he conceived all peoples as partners in one common undertaking. The next author considered by BURY is FRANCIS BACON for whom utility was the end of knowledge. But a greater step forward, — perhaps the greatest single step in the whole history of this idea, — was taken by DESCARTES. For it was only after the supremacy of reason and the invariability of the laws of nature had been proclaimed that the notion of progress could really flourish. A little later, at the close of the Cartesian period, FONTENELLE was the first to formulate the idea of scientific progress as a complete doctrine, and he contributed a great deal to its diffusion by his brilliant efforts to popularize accurate knowledge. The first, however, to « express in definite terms the vista of an immensely long progressive life in front of humanity », to conceive civilization as

(1) Venit tempus, quo posteri nostri tam aperta nos nescisse mirentur, *Natur. quaest.*, VII, 25.

being only in its infancy, was the good abbé DE SAINT-PIERRE in 1737. The development of the idea of progress was now considerably activated by the work of TURGOR, who anticipated COMTE's law of the three stages, and by the Encyclopædists. The latter indeed were inspired by two conceptions which were, so to say, fragments of the idea of progress : the solidarity of the sciences (already clearly seen by ROGER BACON) and the popularization of knowledge. They believed implicitly in the « indefinite malleability of human nature by education and institutions » and consequently in its indefinite improvement.

These efforts and some others which may be found in BURY's book constitute what may be called the first period in the history of the idea of progress. This first period extends up to the French Revolution. A new period was opened (1774) by KANT, who saw the immense significance of this idea but made it clear that nothing could be affirmed about the course of civilization until the laws of its movement had been discovered. That is what COMTE tried to do. This second period is characterized by the search for a definite law of progress; incidentally, sociology was founded. A third period may be said to begin in 1859, with the publication of the *Origin of Species*, though the most effective extension of the idea of evolution to that of social progress, SPENCER's contribution, partly antedated DARWIN's discovery. However, it was the Darwinian, rather than the Spencerian theories, which established the notion of progress in its present commanding position.

No definite law of progress has yet been formulated, yet this idea dominates modern thought and inspires modern action. The tremendous compelling power of the principle of duty to posterity — a direct consequence of our belief in progress — is the best proof of this.

My summary, however brief, is, I hope, sufficient to show the importance of BURY's book. It is truly an excellent book, one of the best I have read for a long time. My only criticism of it is that the notes have been placed at the end of the volume, which is most irritating. Should this disposition be kept in later editions, I would suggest that asterisks be inserted in the text to warn the reader of the presence of a note.

G. SARTON.

Reiche, Fritz. Die Quantentheorie. Ihr Ursprung und ihre Entwicklung. vi + 231 p. Berlin, SPRINGEN, 1921.

This little book is essentially an expanded edition of the essay published by the author in the number of the journal *Die Naturwissen-*

schaften devoted to PLANCK. It is a clear and comprehensive summary of the theory of quanta. Mathematical developments have been avoided as much as possible or rejected in the notes printed at the end of the volume (p. 162-231). REICHE's book will be very useful not simply to the student of physics, but also to the historian of modern science. MAX PLANCK's theory was born in 1900; it was one of the last great achievements of the nineteenth cent. In fact, PLANCK's discovery was perhaps the greatest event of the year 1900, together with the rediscovery of MENDEL's ideas. The theory of relativity was a consequence of the MICHELSON-MORLEY experiment; in the same way, the theory of quanta resulted from the difference between calculated and observed values of the radiation of a black body. The student of the history of physics will do well to read REICHE's book because of the light it throws retrospectively upon the development of our ideas on radiation. The theory of quanta is still full of mystery; suggestive and useful as it is, one can but feel that we have not yet reached the bottom of it, and such a feeling is extremely stimulating.

GEORGE SARTON.

George Sidney Brett. *A History of Psychology*, vol. II, 394, p. and Vol. III, 322 p. London, GEORGE ALLEN & UNWIN, and New York, MACMILLAN, 1921.

G. S. BRETT, professor of philosophy in the University of Toronto, has now completed his work on the history of psychology, the first volume of which appeared in 1912. This first volume dealt with the Ancient and Patristic Psychology; the second volume covers the Mediæval & Early Modern Period, and the third treats of Modern Psychology. This is the best work that has yet appeared in this field; it will soon be recognized and long be remembered as a classic among books concerning the history of the sciences. It should be read by every student of philosophy and psychology. The writer of this review can bear witness to the value of these three volumes for such instructors as may undertake to offer courses for graduate students in the history of psychology. Professor BRETT's mastery of up-to-date psychology in its various departments, his knowledge of the philosophical foundations of this discipline, and the critical acumen he brings to bear on the great problems must command the respect and stimulate the interest of all advanced students of psychology.

After a careful reading of the whole work one is impelled to ask whether a knowledge of its contents might not lead our professors of psychology to reform their methods of presenting their subject to

undergraduates. Is it not possible that the history of psychology, as the history of science in general, might exert a humanizing influence on both student and instructor? Would the WEBER-FECHNER « Law » be presented in the same spirit if the criticisms that have been leveled against it were known and appreciated? Would the « JAMES-LANGE » Theory of the Emotions call forth the same attitude in instructor and student if the views of ARISTOTLE and LOTZE, and many others, in reference to the relation of emotions and physiological concomitants, could be studied along with the views of LANGE and JAMES?

« It is an open question », writes Professor BRETT, « whether a psychologist can be an idealist or a realist. He should perhaps be simply a psychologist. But apart from collectors of detail and writers of monographs, history has failed to produce a psychologist who was not a philosopher of some kind; and it is notorious that a rejection of all metaphysics is the most metaphysical of all positions. The fruits of the sciences may be plucked by every chance comer; yet the tree that bears them must strike its roots deep or quickly wither away. » Whether Professor BRETT's readers are in full sympathy with this passage or not, even those most inclined to positivism cannot deny that much of our present-day psychology is very superficial, and that its foundations — so far as it has any — will not bear the test of criticism. To our lack of well grounded principles, our inadequate knowledge of the history of psychology, other charges must be added — essential ignorance of mental disease, physiology, anatomy, and neurology. Should we attempt to « explain » the soul in terms of the autonomic system and the neurons if we have never handled a scalpel nor looked down a microscope? Moreover, should the court of the Queen of the Humanities be crowded by those who have never read SHAKESPEARE nor turned a page of MOLIÈRE?

Professor BRETT connects the history of psychology with the history of the other sciences, as well as with the history of philosophy. He shows the influence of NEWTON's discovery of the law of gravitation on the English Associationism of the eighteenth century, the results of the physiological researches of JOHANNES MÜLLER and his pupils on the nineteenth century psychology, and the influence on the mental sciences, at various periods, of natural history and biology. Professor BRETT is familiar with the history of anatomy and the medical sciences in general. His sketch, however, of anatomy in the fourteenth, fifteenth, and sixteenth centuries (page 141, vol. II) is in need of some revision. For example, no mention is made of the dissections of LEONARDO DA VINCI. The first edition of the *De Humani Corporis Fabrica* appeared before, not after, the discovery by SERVETUS of the lesser circulation of the blood.

Those interested in the history of science will welcome Professor BRETT's recognition of CABANIS as the founder of modern physiological psychology. Does not ROUSSEAU deserve a larger place than this work gives him as the father of child-study? It is a mistake to say that WUNDT became the successor of HERBART at Leipzig (p. 152, vol. III). Among minor errors and misprints might be noted : 1660 as the date for the death of DESCARTES, instead of 1650 (p. 194, vol. II); *Réné* for René (p. 197, vol. II); *Cherburg* for Cherbury (p. 222, vol. II); *lead* for leads (p. 352, vol. II); *bei Kinder* for *bei Kindern* (p. 337, vol. II); *Rapports de physique et de morale de l'homme* instead of *Rapports du physique et du moral de l'homme* (p. 388, vol. II); *keine Gedanke* for *kein Gedanke* (p. 173, vol. III); *Russell Wallace* for *Russel Wallace* (p. 225, vol. III); *élan vitale* for *élan vital* (p. 267, vol. III); *langage intérieure* for *langage intérieur* (p. 312, vol. III). Professor BRETT speaks of BICHAT as the founder of modern anatomy, where the expression founder of general anatomy (that is, an anatomy of the tissues) is to be preferred.

WALTER LIBBY.

Lewis Spence. *An Introduction to Mythology.* 335 p. London, HARRAP, 1921.

« The purpose of this book is to provide the reader with a review of mythic science from its beginnings down to the latest guesses of contemporary authorities ». That is, the author is chiefly concerned with the principles of mythology, and furthermore with the development of these principles. This book is thus of direct concern to the historian of science, who might not be interested in mythology itself, — though it is impossible to understand the beginnings of science without reference to it, — but who can not help being interested in the history of mythology, in the evolution of human ideas concerning myths. Mr. LEWIS SPENCE has already written many useful books dealing with mythology, chiefly of tropical America, and what he calls an « introduction », is for him rather a conclusion.

An introductory chapter is devoted to definitions and general questions. « The function of mythology is the investigation and explanation of myths or tales relating to the early religious and scientific experiences of mankind. It throws light upon the material, methods, and progress of primitive religion and science, for many myths are an attempt to explain physical as well as religious phenomena ». After this preliminary definition, the author quotes many others to determine more exactly what mythology is and what it is not, and to differentiate it from other objects of study, such as folklore, legend, religion. Chapter II, to which I shall come back pre-

sently, deals with the « Progress of mythic science » (p. 40-101), and the remaining chapters treat successively the following topics: III, the evolution of the gods; IV, the various types of deity; V, the various classes of myth; VI, the making of the world and of man (cosmogony); VII, paradise and hell; VIII, folklore and myth; IX, ritual and myth; X, the written sources of myth; XI, the great mythic systems of the world. — It is, as one sees, a brief but comprehensive encyclopaedia of comparative mythology. Its usefulness to the student is greatly enhanced by excellent comparative tables, on the various classes of myths (p. 144-157) and on the principal creation myths (193-194). Of course chapter VI on cosmogony, is of special importance for the student of early science.

Chapter II offers us a very interesting history of mythological science from XENOPHANES of Colophon to our days. I think it worth while to quote rapidly the principal personalities considered by Mr. SPENCE: XENOPHANES; THEAGENES OF RHEGIUM; PHERECYDES OF SYROS; HECATAEUS OF MILET; PHERECYDES OF LEROS; EUHEMERUS (IVth cent. B. C.);; FRANCIS BACON; DE BROSSES (the first writer to strike upon the true line of interpretation, 1760); LAFITAU (1724); FRIEDRICH SCHELLING; CREUZER; K. O. MÜLLER (the truly scientific treatment of myths begins with his *Prolegomena zu einer wissenschaftlichen Mythologie*, 1825). Then comes the « philological school » grouped around MAX MÜLLER (1823-1900), from which arose later two sub-schools, the solar headed by MÜLLER himself (they saw sun-gods everywhere) and the meteorological, led by KUHN and DARMESTER (they saw in all myths the phenomena of thunder and lightning). But it was not possible to explain everything in this way and the « anthropological school » developed, as more Aryan and non-Aryan myths were shown to be identical. Sir E.-B. TYLOR was first to lay down the anthropological point of view with clearness and accuracy (*Researches into the early history of mankind* 1865, *Primitive culture* 1871); JOHN FERGUSON MC LENNAN (totemism); HERBERT SPENCER; WILLIAM ROBERTSON SMITH; CORNELIUS PETRUS TIELE; ANDREW LANG. The latter was the more influential exponent of the anthropological school; he demonstrated the unsoundness of the « disease of language » theory; laid stress upon the irrational element in myth; indicated the complexity of mythic development; applied the idea of evolution to mythology; showed that the persistence of myth is caused by religious conservatism. Of our contemporaries, the following have attracted particularly the author's attention: Sir JAMES GEORGE FRAZER, of course; E.-J. PAYNE; SALOMON REINCAH; F.-B. JEVONS (reflection of myth by ritual); R.-R. MARETT; Sir GEORGE LAURENCE GOMME; RENDEL HARRIS, and finally GEORGE ELLIOT SMITH whom he names « the Galileo

of mythology », a description which will not be universally approved. Prof. SMITH, it may be recalled, is the chief supporter of the pan-Egyptian theory : he finds traces of Egyptian influence everywhere, even in America.

GEORGE SARTON.

Charles Singer (editor). *Studies in the history and method of science.*

Volume II, XXII + 559 p., LV pl. and other illustr. Oxford, Clarendon Press, 1921 [L. 2. 8. 0].

I have reviewed the first volume of the *Studies in Science*, vol. 47, p. 316-319, and its contents have been analyzed in the Seventh Critical Bibliography. The new volume shows in every respect great progress upon the first; it is considerably larger and its contents are more varied. There are in all fifteen memoirs which can be classified as follows : 7 deal with biological or medical sciences, 4 with physical sciences, 1 with mediaeval science in general, 3 with philosophical questions. Or in another way : there are 12 original memoirs; 2 extensive reviews and 1 translation.

Each of these items will be analyzed in the bibliography, but I must speak at greater length of the first memoir by CHARLES SINGER on *Greek biology and its relation to the rise of modern biology*, not simply because of its importance, but also because of its polymorphism, — of the impossibility of classifying it anywhere. Of course it is a study of the development of biology, but to call it a study of Greek biology would be misleading for it contains a great deal of information on mediaeval subjects. As a matter of fact, its most original part is a study of mediaeval botany ! This very valuable memoir is not simply « polymorphic », but highly heterogeneous. The first chapters are devoted to a general comparison between the spirit and methods of ancient and modern science. This is very suggestive, and I am in agreement with Singer on all points, except when he tries to minimize the importance of the recovery of the original texts of the Greek scientific classics. I think that SINGER overstates his case. He is right when he says (p. 6) : « Above all, we need to distinguish mere *passive increase* of knowledge brought by the revival of the Greek language from the *active extension* of knowledge by direct observation that is the essence of the experimental method. This process of active extension began centuries before the learned Greek revival and received its great impetus long after it. » Yet the fact remains that in the xvth century the shortest road to science as distinguished from a mere accumulation of facts) was the recovery of ancient science in its pristine purity. Greek science was the fruit of the sustained efforts of some of the greatest intellects of mankind ;

it represented the accumulated experience and wisdom of many centuries. If the results of these efforts had not been recovered, the progress of modern science would have been considerably delayed. The study of Greek was as essential in the fifteenth century as the study of one of the European languages is now to any Oriental who wishes to undertake scientific investigations. That is what men like PURBACH and REGIOMONTANUS clearly understood. It is possible that our misunderstanding on this subject is largely due to the fact that SINGER's standpoint is that of the biologist, while mine is rather that of the astronomer and mathematician. After this introduction follow two chapters (III, IV) dealing with Aristotelian biology. In the first of these SINGER examines very carefully its fundamental ideas (classification; phylogeny; ontogeny); in the second he gives us a very interesting account of « some Aristotelian zoological observations and their modern counterparts », to wit: the placental shark, the ruminant stomach, the generative processes of cephalopods, the habits of the fishing-frog, torpedo and bees. These two chapters contain nothing which is essentially new, but one must be grateful to SINGER for his very lucid exposition, and the readers who are not professional zoologists will especially appreciate the abundant illustrations. As far as I am concerned, this is the first time that I have been able to study Aristotelian zoology without continual and tiring reference to zoological textbooks. The two last chapters (V, VI) are botanical. They contain an elaborate investigation of Greek botany, and SINGER's account of THEOPHRASTUS has the same qualities of clearness and simplicity as his account of ARISTOTLE, but the chief feature of these chapters (and indeed of the whole memoir) is a study of mediaeval botany; that is essentially, a study of botanical iconography (V, b and c). The author is here at his best. He has made a rich collection of the botanical and biological pictures to be found in early manuscripts and a great deal of this material is entirely new. The memoir contains admirable reproductions (some in colour) of these early pictures. The reader can but regret, however, that these illustrations are not more intimately connected with the text (1). Sometimes one has the painful feeling that the text is telling one story, and the pictures another. At any rate it is certain that the greatest defect of this rich memoir is its heterogeneity: for it would have been much better to devote a separate study to the development of botanical images. The same lack of method becomes even more conspicuous when the author interrupts his narrative to give us a list of the

1) Some, including the beautiful frontispiece, are not explained at all!

manuscripts of DIOSCORIDES (p. 64-66) or, in another memoir, of those of ALHAZEN (p. 393). (1).

The illustrations are very abundant and generally well chosen though they are not always sufficiently subordinated to the text. Their beauty justifies the very high cost of this book, which on their account will appeal very much to certain *dilettanti*. The author's love of illustrations is so great that he is sometimes led astray by it, as for example when he included pl. XLI, representing the Hall of the GALILEO museum in Florence, a monument of bad taste of which every Italian artist is ashamed.

The preface is unpleasant. It is curious that after having taken such pains to edit this splendid volume, SINGER should risk spoiling it all by writing the preface in such a careless way. It is purposed to be a review of contemporary work in the history of science, and SINGER proceeds, so to speak, to distribute good notes to his colleagues of various countries. That may be a generous idea, but if done at all, it should be done very well. SINGER's selection is invidious, for it is far from being comprehensive and, while many smaller names are included, some of the greatest are omitted. Let us hope that this tradition of poor prefaces will be stopped as soon as possible (a preface is not indispensable) and that the *Studies* — which are now to appear annually — will enjoy a long and prosperous life. G. S.

Émile Meyerson. De l'explication dans les sciences. in 8°, 1^{er} vol. XIV + 338 pages; 2^e vol. 470 pages. Paris, PAYOT, 1921.

Voici un livre qui fait penser et qui en conséquence doit être lu par ceux que la philosophie et l'histoire des sciences intéressent. L'auteur s'est demandé quelle est la véritable portée de l'explication scientifique, quelle est sa valeur de savoir, dans quelles conditions les sayants la recherchent, dans quelles circonstances elle les satisfait ou encore elle les déçoit. Il n'a pas cherché à résoudre ce problème à l'aide d'une théorie de la connaissance posée *a priori* par un système philosophique; mais en interrogeant habilement les chercheurs de tous les temps et de tous les pays, il a découvert dans la lecture attentive de leurs œuvres les tendances profondes de leur intelligence et de leur volonté qui sont souvent bien différentes des principes méthodologiques que les auteurs déclarent adopter.

Dans le compte rendu d'un ouvrage aussi important, l'on ne peut

(1) An appendix contains a lists of 82 MSS. of Aristotelian biological works in English libraries. That is excellent.

songer ni à suivre pas à pas la pensée de l'auteur ni à discuter ses conclusions. Jetons un coup d'œil sur le point de départ et le point d'arrivée de ses méditations pour apercevoir l'ensemble et nous rendre compte de tout l'intérêt qu'elles présentent.

Il a commencé par établir que, contrairement aux affirmations retentissantes du positivisme, la science ne peut se passer d'attribuer à des « choses » une existence objective. Sous les phénomènes variés, sous les apparences qui nous sont seules accessibles, elle suppose une réalité ontologique persistante. Avec la même fermeté M. MEYERSON montre que — quelles que soient les illusions ou les prétentions des savants — l'esprit humain est incapable de s'arrêter à l'énoncé brut des lois physiques, résumés d'observations empiriques dont nous constatons la validité, mais qui ne s'imposent pas de force à notre raison ; cela ne nous suffit point. Car non seulement notre entendement aspire à savoir ce qu'en fait les choses sont, mais encore il veut être assuré qu'en droit elles ne sauraient être autrement qu'elles ne sont. A la description légale, il a tendance à substituer l'explication causale.

Mais qu'est-ce que l'explication causale ? M. MEYERSON l'étudie dans toutes ses modalités et dans toutes les sciences ; avec une richesse de documentation remarquable il nous la montre déduisant les faits de leurs antécédents, puis, établissant comment ils sont fonction les uns des autres, enfin démontrant — ou aspirant à démontrer — qu'ils sont logiquement nécessaires : bref, que le monde entier est perméable à notre raison.

Pour parvenir à ce résultat, comment procède notre intellect ? Déjà le sens commun substitue à notre vision immédiate et inconsistante du monde sensible des objets plus stables et plus simples qui lui sont équivalents ; la science, l'auteur le montre avec des exemples à l'appui, poursuivant ce travail par une méthode semblable, détruit l'ontologie du sens commun et remplace ses objets par d'autres plus simples et plus stables ; puis, par le même processus, elle remplace cette ontologie par une plus simple. Enfin, avec le mécanisme, elle ne laisse subsister que l'espace et seules les différences entre les figures et les mouvements doivent expliquer les différences entre les choses. Nous aboutissons, cela se voit, à proclamer qu'historiquement et logiquement le conséquent est équivalent à l'antécédent qui le précède et dont il procède. En réduisant notre image du monde à des modifications de l'espace, nous affirmons sa similitude éternelle, nous nions le « devenir » ou tout au moins le nouveau. Mais si nous rendons raison par là du déterminisme de la nature, nous ne sommes pas encore satisfaits ; la diversité dans l'espace doit être expliquée comme la diversité dans le temps. En suivant le penchant de notre raison, nous dissoudrions la

réalité dans l'espace indifférencié, détruisant finalement l'ontologie que nous avions d'abord posée, renonçant en définitive à expliquer le monde dont la diversité ne peut se ramener à l'identique.

C'est que la réalité résiste à la contrainte de notre raison; elle n'y résiste, il est vrai, pas complètement, puisque la science est possible, qu'elle est parvenue dans une certaine mesure à expliquer le réel, et que comme le montre un examen attentif ses efforts pour le rationaliser n'ont pas été entièrement vains. Mais enfin elle y résiste, puisque au terme de ses déductions la science rencontre l'irrationnel qu'elle renonce provisoirement à expliquer! La lecture d'ouvrages scientifiques nous convainc de cette vérité, et l'irrationnel, la science le rencontre souvent là où elle ne le prévoyait pas, elle est obligée de l'accueillir.

Si la science est explicative, elle est loin, ne l'oublions pas, d'être uniquement explicative; elle vise à être une image du réel qui, ainsi que nous l'avons vu, ne pouvant se ramener à l'identique, est par essence inexplicable! Et ces deux tendances de la science qui en un sens sont opposées, antagonistes, coexistent paisiblement dans la science moderne; les principes de conservation, celui de la conservation de l'énergie par exemple, posent l'immutabilité du monde, alors que les irrationnels, le principe de Carnot en particulier, reconnaissent que cette immutabilité est impossible.

Cette opposition, ou, si l'on veut, cette contradiction entre les tendances de la science, ne lui est point particulière; elle se retrouverait dans les systèmes philosophiques ou même dans les affirmations instinctives du sens commun. L'histoire montre qu'elle est aussi ancienne que la science ou que la philosophie, et à cet égard, l'étude de la pensée du passé est aussi instructive que l'étude de la pensée moderne. La raison humaine depuis l'antiquité n'a point varié. — « Tout le monde, toujours, en toute circonstance, a raisonné et raisonne selon un mode essentiellement invariable ». Telle est la conclusion à laquelle aboutit M. MEYERSON. Cette conclusion, il y parvient après avoir écarté les objections des savants et des philosophes, après avoir analysé la logique de HEGEL; chemin faisant il utilise comme documents la pensée d'un grand nombre d'auteurs, qu'il semble pénétrer à fond; son érudition est immense. Mais à l'exception d'un appendice consacré à l'opposition des chimistes aux doctrines de LAVOISIER, les textes des savants sont choisis uniquement afin d'illustrer la thèse de l'auteur; s'il utilise l'histoire des sciences, il ne prétend point faire œuvre d'historien.

Or, l'histoire méthodique des sciences physiques n'est pas encore fort avancée et souvent elle hésite sur sa méthode et sur son but. Parmi les enseignements que l'on peut tirer des livres de M. MEYERSON,

de même que de son ouvrage précédent *Identité et réalité*, un des plus précieux est que cette histoire ne satisfait pas seulement une curiosité, certes légitime, mais stérile; qu'elle peut fournir au philosophe une base lui permettant de mieux connaître la marche de l'esprit humain.

(Paris.)

HÉLÈNE METZGER.

Hugo Dingler. PHYSIK UND HYPOTHESE. Versuch einer induktiven Wissenschaftslehre nebst einer kritischen Analyse der Fundamente der Relativitätstheorie; pp. xi + 200. Berlin und Leipzig, Vereinigung wissenschaftlicher Verleger. 1921.

Professor DINGLER's book on Physics and Hypothesis consists of a discussion of the concept of rigid body, of the nature of scientific hypothesis, and of some of the underlying epistemological problems.

All experiment, according to the author, rests on the notion of a rigid body. A rigid body, however, cannot itself be established experimentally. Hence, there can be no such thing as a *purely* experimental physics; hypotheses must be introduced.

The discussion of the nature of hypothesis constitutes the most important part of the book. That the formal architecture of scientific hypotheses, and the interpretations of hypotheses in terms of physical « reality », can best be comprehended by a study of postulational theory and technique as developed so fruitfully in recent years by mathematical logic, is a thesis well worth emphasizing.

The last portion of the book is devoted to a metaphysical attack upon all relativity theories in science.

(Cambridge, Mass.)

H.-M. SHEFFER.

Stone, Gilbert. A History of Labour. 416 p. London, Harrap. August 1921. (15 s.)

Mr. STONE, sometime secretary to the British coal industry commission, has written for the general reader a very entertaining and well-informed book. It is not meant for special students of the subject, but other students will enjoy it, for, though the author has not carried on any original investigations, he has made good use of some of the best secondary sources and he is remarkably free from prejudice and from those rhapsodical tendencies so common among popular writers on social problems. I do not say that he has no bias, but simply that he is very tolerant and judicial. He rejoices in the emancipation of the masses and in the gradual extension to them of a freedom and happiness which for centuries had remained the privilege of the very few. He thinks that the process of emancipation is far

from being complete, but that it must be slow to be sound, and that, as more power and opportunities accrue to the labouring people, they will of necessity realize more keenly their obligations. He insists, in my opinion very wisely, on the fact that labour problems do not result simply from conflicts of economic interests (p. 216): « The opposition is not between the worker and the capitalist; it is between the man who works, who suffers, who experiences, who knows and the man who never works, never suffers, never experiences and never knows. » I would say, in other words, that this opposition is not only a conflict of material interests, but is also to a degree but another face of the old conflict between ignorance and superstition on the one hand and scientific knowledge and method on the other. And this concerns us directly: Social progress is a function of the progress of knowledge; it is our business and duty to prove it.

The subject of Mr. STONE's book is at once less and more comprehensive than the title suggests. It is not international, but largely restricted to England. It is true, the first chapter deals with Roman slavery and mediaeval serfdom, but that seems a proper introduction. There are also not a few references to conditions in France and the United States, but not more than one would expect in any history of British labour for the purpose of comparison and explanation. For example, the French Revolution marks an important date in English history, and it influenced social problems in England just as the Russian Revolution is now affecting them — and will affect them more and more — in one way or another, all over the world. On the other hand, to illustrate the gradual improvement in the condition of workmen, Mr. STONE has thought it well to explain the contemporary progress in politics and education. His way of limiting and treating the subject seems to me to be adequate to the aim of his book.

After having surveyed the progress accomplished down to our day, the author quotes, with evident pleasure, MACAULAY's conclusion: « The more carefully we examine the history of the past, the more reason shall we find to dissent from those who imagine that our age has been fruitful of new social evils. The truth is that the evils are, with scarcely an exception, old. That which is new is the intelligence which discerns and the humanity which remedies them. » This is very true, yet such complacency should not be encouraged, for it is not conducive to further advance. It serves no useful purpose to think of how good we are; it is better to realize more keenly our deficiencies and strive to correct them. Whatever social progress has been made we owe, not to the self-satisfied optimists, but to those who saw clearly the evils of their time and kicked vigorously until they were eradicated.

GEORGE SARTON.

John Koren (*editor*). *The History of Statistics. Their development and progress in many countries. Memoirs to commemorate the seventy-fifth anniversary of the American Statistical Association.* XII + 773 p. New-York, MACMILLAN, 1918.

The American Statistical Association having decided to mark its seventy-fifth anniversary by «a serviceable contribution to our knowledge of statistics», invited the leading statisticians of many civilized countries to explain the development of their respective national statistics, and has published their reports in the present volume which will remain a historical monument of the first order. Truly this is not a history of statistics, which is still badly needed, but it will offer to the future historian of this fundamental discipline a very valuable collection of materials and will enable him to reach easily a great deal of additional information.

It is interesting to note that the American Statistical Association was founded as early as 1839 (at no. 15 Cornhill, Boston). Its objects had been very broadly defined: «to collect, preserve and diffuse statistical information in the different departments of human knowledge». Its first foreign member was ADOLPHE QUETELET. The signification of these early efforts will be better appreciated if one realizes that in 1839, there were only two other similar organizations in existence, the Manchester Statistical Society founded in 1833 and the London (now Royal) Statistical Society founded in 1835. The *Journal of the London Society* began to appear in 1838, — but the *British Annual Register* was born as early as 1758. The *Statistical Abstract of Great Britain* dates of c. 1855; it was the first of the many national annuals now published. The *Statistical Abstract of the U. S.* dates of 1878. The *New-York Tribune Almanac* dates of 1838.

No nation spends more money and energy in the compilation of statistics than the United States, but, as S. N. D. NORTH has remarked, it is certain that much of the expenditure is wasted. The Constitution ordained that a census of the population be taken in 1790 and every tenth year thereafter, and this has been done faithfully, with increasing comprehensiveness and accuracy. It is interesting to note that it was just a century later, in 1890, that ROBERT P. PORTER, director of the Eleventh Census, introduced the automatic tabulation: a technical progress of enormous scope. To the federal statistics must be added those undertaken by the 48 separate states and by private organizations (for ex. insurance societies of tremendous power). It is then perhaps less astonishing that the American association is one of the oldest of its kind in the world.

KOREN's History is divided as follows. An introductory article by

himself relates the history of the association. S. N. D. NORTH gives a rapid survey of the progress of statistics since 1839 and shows the outlook for the future. Then follow a series of memoirs explaining the development of statistics in fifteen different countries :

Australia, by GEORGE HANDLEY KNIBBS,
 Austria, by ROBERT MEYER,
 Belgium, by ARMAND JULIN,
 Canada, by ERNEST H. GODFREY,
 Denmark, by ADOLF JENSEN,
 France, by FERNAND FAURE,
 Germany, by EUGENE WÜRZBURGER,
 Great Britain and Ireland, by SIR ATHELSTANE BAINES,
 Hungary, by LADISLAUS VON BUDAY,
 India, by SIR ATHELSTANE BAINES,
 Netherlands, by C.-A. VERRIJN STUART,
 Norway, by A.-N. KLAER,
 Russia, by A. KAUFMANN,
 Sweden, by EDVARD AROSENIUS,
 United States, by JOHN CUMMINGS (federal stat.) and CHARLES F. GET-
 TEMY (state stat.).

(The absence of reports relating to Italy and Japan is not due to the editor's negligence, as such reports had been promised to him respectively by C. A. ASCHIERI and S. TAKARABE, — but I find no mention of the great South American republics!)

It is impossible to summarize these reports, which are very full. They are also very unequal, a circumstance which it is easier to deplore than to avoid. The longest report is the one dealing with the United States (167 p.), then follow the French report (117 p.), the Russian (69 p.), the Belgian (55 p.), the Austrian (41 p.) etc. An elaborate index makes it easy to use this excellent book for the solution of particular problems,

This survey of the progress of statistics in various parts of the world was accomplished at the most suitable time, for it is safe to assume that the Great War closes an old period and opens a new one. May we hope that the new era will see a new development of international statistics? This is of course an ambitious dream — for international statistics imply international comparability, and comparability implies unification of methods. The problems to be solved are numerous and very complex, and complete unification will be difficult to accomplish. Yet it is only to the extent that international statis-

ties are realized that it will ever be possible to appreciate accurately human welfare and progress, and to prepare a scientific history of social endeavours. The International Statistical Institute, founded in 1885 (1), may become a powerful agency to attain this aim : its efforts should be encouraged and its power strengthened by all means.

G. SARTON

(1) Apropos of this see the *Annuaire de la Vie Internationale*, vol. II, Bruxelles 1940-41, p. 1059-65, also NORTH's article above-mentioned, p. 47. Nine statistical congresses were held from 1853 to 1876, the first in Brussels, the last in Budapest. The International Institute was founded at the London Statistical Jubilee of 1885, and has held biennial meetings at least until the war. The publication of its *Bulletin* began in 1886.

Eleventh Critical Bibliography

of the History and Philosophy of Science and of the History
of Civilization

(to October 1921)

This Eleventh Bibliography contains about 411 notes, of which a few have been contributed by L. GUINET (Brussels). The arrangement and leading principles of this bibliography have been fully explained in volume III, 159-171; a complete plan of classification will be found also in the present volume, p. 124-125. The reader will keep in mind that Part I is the fundamental classification (centurial) and that Parts II and III contain only such items as could not be included in Part I.

As this bibliography appears only twice a year, I beg the authors to take pains that books and papers on the history and philosophy of science and the history of civilization, be sent to me as soon as they are published. Even then almost a year may elapse before they are included.

The aim of this bibliography is to establish the History of Science as an independent discipline and to serve as a center of information and a rallying ground to the scholars engaged in these studies. I can not succeed entirely without their assistance, and they can help me in many ways. To serve them, as well as I can, is both my duty and my pleasure. Critical work must be approached in a spirit of service or left untouched.

24, Agassiz Street,
Cambridge, Massachusetts,
October 1921.

GEORGE SARTON.

Authors' Index.

The Roman figures refer to centuries, the other words, as *China*, *astronomy*, etc., refer to the sections of Parts II and III bearing these titles. The index will enable one to find more easily the papers analyzed in the present bibliography, and also to see at a glance what everybody is doing.

ELIZABETH GILPATRICK.

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PART I

Fundamental Classification (centurial).

S. VI A. C.

Beazley, John Davidson. Attic red-figured vases in American museums. x + 236 p., 118 fig. Cambridge, Mass. Harvard University Press, 1918. 1918

The vases dealt with date from the end of the sixth century to the end of the fifth or the beginning of the fourth, — in other words from the work of the ANDOKIDÆS painter (one of the first artists to use the red-figured style) to the Meidias hydria. There are abundant references to the non-American vases. G. S.

Hopkin, Joseph Clark. A handbook of Attic red figured vases signed by or attributed to the various masters of the sixth and fifth centuries B. C. Cambridge, Harvard University Press, 2 vol. xxiv + 472 p., VIII + 600 p., 1919. 1919

An elaborate *catalogue raisonné* with many illustrations and copious indexes. The order adopted by the author is the alphabetical order of painters and potters, and secondarily the alphabetical order of museums. No attributions have been included unless some scholar has definitely assigned a given vase to a certain hand; the author himself has not added attributions of his own except when obliged to choose between conflicting attributions. The illustrations are small but very good. G. S.

S. V A. C.

Krause, Ernst. DIOGENES von Apollonia. *Janus* 1909, 228-241, 570-584; 1914, 380-384; 1915, 314-326, 505. 1918

S. IV A. C

Diels, H. Über PLATONS Nachtuhr. *Sitzungsber. d. Kgl. preuss. Akad. d. Wiss.*, J. 1915, p. 824-830. Berlin 1915. 1918

« Ich halte die gut bezeugte Ueberlieferung, dass die erste Weckeruhr von PLATON konstruiert worden ist, für ebenso wichtig wie die Nachricht des APOLLONIOS über den Flötenspieler des ARCHIMEDES... ». A propos of a fragment of ATHENAEUS, IV, p. 174 DIELS tries to reconstruct this clock. G. S.

Endrös, A. Die Gezeiten, Seiches und Strömungen des Meeres bei ARISTOTELES. *Sitzungsber d. bayer. Ges. d. Wiss., math. phys. Kl.*, München 1915, 355-385. 1919

This paper is a sequel to the author's previous one on the Euripus question (*Isis*, IV, 442). ARISTOTLE had solved this question in the same way as F.-A. FORKEL! For he knew the phenomenon called *seiche* and its causes. He also knew that the waves are caused by the wind and by the quaking of the Earth. He could understand the Euripus currents, but not the mysterious tidal anomalies near Chalcis. It is an error to believe that he conceived the tides as a respiration of the Earth. G. S.

Mühl, Peter Von der. ΕΠΙΚΟΥΡΟΙ ΚΥΡΙΑΙ ΔΟΞΑΙ und DEMOKRIT. Festgabe ADOLF KAEGI, Frauenfeld, 1919, p. 172-178. 1818

Platt, Arthur. ARISTOTLE on the Heart. *Studies in the history of science*, vol. II, 521-532. Oxford 1921. 1818

Rufini, Enrico. Gli studi geometrici di EUDOSSO da Cnido *Archivio di storia della scienza*, vol. II, 222-239, Roma 1921. 1818

A careful survey of EUDOXUS' geometrical work. The author concludes that this work marked the beginning of a new era; with him, geometry ceased to be empirical and tentative. His generalization of the theory of proportion extended the field of geometry into regions hitherto unexplored; his method of exhaustion offered a new instrument of research and of proof and stopped for a while vain discussions on infinity. G. S.

Wilamowitz-Moellendorff, Ulrich von. PLATON, I. Bd. Leben und Werke; 2. Bd. Beilagen und Textkritik vi + 756 p., 452 p. Berlin, WEIDMANN, 1919. 1818

S. III A. C.

Cajori, Florian. EUCLID of Alexandria and the bust of EUCLID of Megara. *Science*, vol. 53, 414. 1921. 1818

The bust of EUCLID of Megara as represented on a Greek coin has been often mistaken for that of EUCLID, the mathematician. The same mistake occurs in the "Portfolio of portraits of eminent mathematicians" edited by D.-E. SMITH in 1896 for the Open Court Company. G. S.

Child, J.-M. ARCHIMEDES' principle of the balance and some criticisms upon it. *Studies in the history of science*, vol. II, 490-520, 25 fig Oxford 1921. 1818

Elaborate criticism of MACH's interpretation of Archimedian statics. G. S.

Smith, Vincent A. ASOKA. The Buddhist emperor of India Third edition revised and enlarged. 278 p., illustr. Oxford, Clarendon Press, 1920 (first ed. 1901; 2d ed. 1909). 1818

S. II A. C.

Bezold, C. SZE-MA TS' IEN und die babylonische Astrologie. Hirths Festschrift, Berlin 1920. 42-49. 1818

According to BEZOLD the Chinese became acquainted with Babylonian astrology probably before 523 B. C. and adapted it to the conceptions which they had already independently developed. He makes a comparison between the Babylonian constellations and those quoted by SSŪ-MA CH' IEN. G. S.

[**Philo of Byzantium**]. Exzerpte aus PHILONS Mechanik B. VII und VIII (vulgo fünftes Buch). Griechisch und Deutsch von H. DIELS und E. SCHRAMM *Abhdl. d. preuss. Akad. d. Wiss., philos.-histor. Kl.*, J. 1919, 84 p. Berlin 1920 1818

This so-called fifth book (since THÉVENOT) of PHILO's Μηχανική σύνταξις is really a collection of extracts from book VII, Παρασκευαστικά and book VIII, Πολιορκητικά. The text now published is based upon the original text edited by RICHARD SCHÖNE. The authors have also availed themselves of the notes by ERNST FABRICIUS, 1886, kept in Ms. in Berlin. There is a technical introduction of 14 pages. G. S.

S. I.

- Boll, Franz.** Aus der Offenbarung JOHANNIS. Hellenistische Studien zum Weltbild der Apokalypse. (*Stoicheia*. Studien zur Geschichte des antiken Weltbildes und der griechischen Wissenschaft, 1) VIII + 151 p. Leipzig, TEUBNER, 1914. 1818

Hellenistische Prophezeiungen. Das Weltbild der Apokalypse. Schalen- und Posaunenvision und ihre Quelle. Das erste Wehe. Die apokalyptischen Reiter. *Regina caeli*.

- Kennedy, J.** Eastern Kings contemporary with the Periplus. *Journal of the R. Asiatic Society*, London 1918. 1818

Criticism of SCHOFF's paper quoted below. The *Periplus* is the result of many years' experience; it was written in colloquial Greek to be a vade mecum for Roman sea-captains trading with the East. It was written in MALICHAS' time and is of a single web and woof throughout (MALICHAS was king of the Nabataeans until A. D. 71). G. S.

- Loeschcke, Siegfried.** Lampen aus Vindonissa. Ein Beitrag zur Geschichte von Vindonissa und des antiken Beleuchtungswesens. 358 p. f°, 23 pl. Zürich, BEER, 1919. 1818

An exhaustive study of the rich collection of lamps found in Vindonissa (= Windisch). It contains about 1100 specimens and is likely the largest collection found in any place beyond the Alps. They date of the first century. G. S.

- [**Manilius**], M. MANILI Astronomicon. Liber quartus. Recensuit et enarravit A.-E. HOUSMAN. XVIII + 130 p. London, GRANT RICHARDS, 1920 [not seen]. 1818

See *Isis*: III, 94.

G. S.

- Schoff, Wilfred H.** The date of the Periplus. *Journal of the R. Asiatic Society*, 1917 (2) 827-830. 1818

SCHOFF adopts the conclusions previously reached by General M.-R. Haig: The author made his voyages at various times between 65 and 75 or 80 A. D. The work was written in the last quarter of the first century. See KENNEDY, *supra*. G. S.

S. II.

- Harris, D. Fraser** On a Latin translation of the complete works of GALEN by ANDREA LAGUNA, M.-D., the Spaniard, Strassburg, 1604. With notes, dedications, a life of GALEN and index. *Annals of medical history*, II, 384-390. New-York, 1919. 1818

In the Library of the Faculty of Medicine, Dalhousie University, Halifax, N. S. This is the 4th ed. of the series of 5 ed. of LAGUNA's GALEN, the first being dated 1548, the 5th, 1643. ANDREA LAGUNA or LACUNA, 1499-1560. G. S.

- Rolleston, J.-D.** LUCIAN and medicine. *Janus*, t. 20, 83-108. Leyde 1915. 1818

LUCIAN's writings contain many allusions to prevalent diseases, especially pneumonia, consumption, alcoholism, gout and fevers (malaria, typhus, typhoid, Malta fevers); no evidence suggestive of syphilis. G. S.

Trotz, Theodor. Der Inhalt der Dresdener lateinischen GALEN handschrift aus dem Anfange des 15 Jahrhunderts. Erster Abdruck der « Oeconomica GALIENI » (*Diss.*, SUDHOFF's Institut, Auszug), 14 p. Leipzig 1921. 1818

This Dresden Ms. is famous for its miniatures, but the texts it contains are equally important. One of the translators is often quoted, NIC. DA REGGIO, who fl. in Calabria in the xvth cent., — but there were other translators and it is unlikely that NIC. DA REGGIO translated GALIEN from the Arabic as the scribe says. This Ms. is analyzed and the text of the following part edited: YCONOMICA GALIENI translata ab ARMENGANDO BLAZII de arabico in latinum in Monte Pessulano, continet IIII capitula (de diviciis servandis, de servis, de uxore, de filiis). G. S.

S. III.

Carpocino, J. La table de mesures des « Mediani ». *Comptes rendus de l'Académie des inscriptions*, 1919, p. 379-387. 1818

A propos d'un autel primitivement dédié à l'empereur MAXIMIN († 258) et converti après sa mort en table de mesures de capacités (deux mesures d'environ 9 et 5 litres). Trouvé en 1918 dans la plaine de Sétif, aux Ouled-Abdallah, à 10 kilomètres Sud-Est de Saint-Arnaud. G. S.

Haentzschel, E. Lösung einer Aufgabe aus der Arithmetik des DIOPHANT. *Jahresbericht der deutschen Mathematiker-Vereinigung*, t. 24, 467-471, Leipzig 1916. 1818

That is, book III, problem 7 (TANNERY's edition, 1893, p. 150-153).

G. S.

Hammer Jensen, M^{me}. Iageborg. Deux papyrus à contenu d'ordre chimique, *Bulletin de l'Acad. royale de Danemark*. Copenhagen 1916, p. 279-302. 1818

Etude sur le Pap. X de Leyde et le Pap. Holmiensis, le premier publié par LEEMANS en 1885, et traduit et commenté par BERTHELOT en 1888; le second — qui est de la même provenance et de la même date — ne fut publié que par LAGERCRANTZ en 1913: ce sont deux monuments fondamentaux pour l'étude de la technologie dans l'Égypte romaine (Cfr. *Isis*, III, 320). G. S.

S. IV.

Bidez, J. La jeunesse de l'empereur JULIEN. *Bull. de l'Académie royale de Belgique (cl. des lettres)*, Bruxelles 1921, 197-216. 1818

Analyse pénétrante du caractère si complexe de JULIEN: « chrétien par ses premières croyances, mais pénétré d'idées païennes par ses études littéraires; plein d'admiration pour le génie de la Grèce ancienne, mais moderne et presque romantique par le sentimentalisme avec lequel il se reportait vers le passé et aussi par l'importance qu'il attachait aux mouvements de son âme inquiète et ardente »... « JULIEN fut surtout un homme de foi et rien ne ressemble plus à certains égards aux effusions de piété dont ses discours sont remplis que le lyrisme — déjà si moderne — des *Confessions* de SAINT AUGUSTIN ». G. S.

Haarhoff, Theodore. Schools of Gaul. A study of Pagan and Christian education in the last century of the Western Empire. XII + 272 p. Oxford University Press, 1920. 1818

A very interesting study based on original authorities, by a South African

scholar now professor at the University of Cape Town. Education in Gaul during the 4th and 5th cent. had not been studied thus far, though it is of great interest for many reasons: it was a period of crisis, education passing through the last stage of official paganism. Yet in spite of the conflicts between Pagan and Christian, Roman and Barbarian, the educational traditions of Rome preserved continuity. The very complexity of conditions (nationality, language) obtaining in Gaul caused her finally to become the leader of the Roman empire in education. Plan: I. Introductory (Greek, Celtic, Germanic influences; Romanization of Gaul; early Roman education in Gaul); II. Pagan education (Inside the school; outside of it); III. Christian education; IV. Certain educational ideas and influences (moral education, history; position of Greek; art); V. Decline of education (Gallic students abroad; invaders; ideals). Select bibliography. G. S.

Jeanselme, E. Le chancre mou existait-il à Alexandrie au iv^e siècle de l'ère chrétienne? *Bull. soc. franç. hist. méd.*, t. 14, 233-238. Paris 1920. 1815

A propos de PALLADI *Hist. Lausiaca* in MIGNE, *Patrol. græc.*, t. 34, col. 1091 sq. — MÉNÉTRIER a fait remarquer que CELSE avait déjà fort bien décrit les ulcérations phagédéniques des organes génitaux, — mais pas que ses prédécesseurs grecs il n'avait mentionné leur origine vénérienne. Dans l'histoire racontée par PALLADIUS cette origine est mise en évidence. G. S.

McClure, M.-L. and Feltoe, C.-L. The pilgrimage of ÆTHERIA. XLVIII + 103 p. London, Society for the promotion of Christian knowledge, 1920. 1818

English transl. of the text translated into German by H. RICHTER. See below. G. S.

Richter, Hermann. Pilgerreise der ÆTHERIA (oder SILVIA) von Aquitanien nach Jerusalem und den heiligen Stätten von Jahre 385 n. Chr.). Gefunden in Arezzo von GAMURINI und 1884 von ihm in Rom hrg. Ins Deutsch übersetzt und mit Einleitung und Anmerkungen versehen. Mit 2 Karten, 1 Plan. u. 8 Ansichten. VIII + 102 p. Essen, BAEDERER, 1919. 1818

If this pilgrimage dates back to 385 it is one of the very oldest of which we have a record. The oldest Latin record of such a pilgrimage is the *Itinerarium Burdigalense*, A. D. 333 and it is very meager; the next is the *Peregrinatio ÆTHERIAE*, here translated; then follow: Eucherius c. 450; THEODOSIUS c. 550; ANTONINUS PLACENTINUS Martyr or Piacenza Anonymus, c. 580; ADAMNANUS, d. 704; BEDA VENERABILIS, c. 750; PETRUS DIACONUS, c. 1137. — However WEYMANN (1908) and KARL MEISTER (1909) have claimed that the *Peregrinatio ÆTHERIAE* dates only of the viii cent. The author states clearly their arguments in his Introduction, and discusses them; he himself is convinced that the date formerly indicated by GAMURINI, c. 385, is the correct one. At any rate, whether the account of this pilgrimage dates of the ivth or the viii cent., it is extremely interesting. G. S.

S. V.

Lanman, Charles Rockwell. BUDDHAGHOSA's treatise on Buddhism, entitled the Way of Salvation. Analysis of Part I, on Morality. *Proc. of the American Acad. of Arts*, vol. 49, p. 149-169, Boston 1913. 1818

The *Visuddhi-magga* was written in Pali at the Great Monastery of

Ceylon in or ab. 410 A. D.: it is one of the most authoritative books on Buddhism. LANMAN is completing an edition and transl. of it, undertaken by his late friend H.-C. WARREN. G. S.

Segalen, Victor. Sépultures des dynasties chinoises du Sud (Epoque des NAN-PEI-TCH'AO, v^e et vi^e siècle après J. C.). *Comptes rendus de l'Acad. des inscriptions* Paris 1917, p. 241-259, 12 fig. 1818

S. VIII.

Fog, Reginald. Der Unholt - Grendel " in BJOVULF. *Janus*, t. 23, 159-166, Leyde, 1918. 1818

[**Zaid ben Ali.**] Corpus Juris di ZAID IBN ALI (VIII Sec. cr.). La più antica raccolta di legislazione e di giurisprudenza musulmana finora ritrovata. Testo arabo pubblicato per la prima volta sui manoscritti Jemenici della Biblioteca Ambrosiana con introduzione storica, apparato critico e indici analitici da EUGENIO GRIFFINI, Dr. Jur. In-4^o picc., excviii + 420 p. Milano, HOEPLI, 1919. 1818

See a study by the same author on ZAID IBN ALI and his code in the *Rend. Ist. Lomb. d. sci. e litt.*, t. 44, 1911, 16 p. G. S.

S. IX.

Suter, Heinrich. Über die Ausmessung der Parabel von THĀBIT B. KURRA AL-HARRĀNĪ. *Sitzungsber. d. physik. medicin. Societät*, t. 48, 65-86, Erlangen 1918. 1818

Contains the translation of the text from a Paris Ms. (DE SLANE, Ms. 2457, 25^o) with commentary. G. S.

Suter, Heinrich. Die Abhandlungen THĀBIT B. KURRAS und ABŪ SAHL AL-KŪHĪ über die Ausmessung der Paraboloid. *Sitzungsber. d. physik. mediz. Gesell.*, t. 48, 186-227, Erlangen 1918. 1818

SUTER translated previously a memoir by IBN AL HAITHAM (965-c. 1039) on the mensuration of the paraboloid (*Bib. math.*, t. 12, 289-332, 1912). In that work IBN AL HAITHAM recalled two other works on the same subject, one by the Sabaean THĀBIT B. KURRA (826-901), the other by the Persian WAIDJAN B. RUSTEM AL-KŪHĪ (fl. 980-1000). SUTER now publishes translations of these works with commentary, concluding that they (and IBN AL HAITHAM's work) are among the choicest fruits of Arabic mathematics: they form, so to say, a transition between the investigations on infinitesimal geometry of ARCHIMEDES and those of LUCA VALERIO, CAVALIERI, KEPLER and WALLIS. G. S.

Vloten, G. van. Ein arabischer Naturphilosoph im 9. Jahrhundert (EL-DSCHĀHĪZ). Aus dem Holländischen (mit einigen Zusätzen) übertragen von O. RESCHER. 47 p. Stuttgart. W. HEPPELER, 1918. 1818

The Dutch text appeared in May 1897, in the *Tweemaandelijksch Tijdschrift*. 'AMR IBN BAHR, surnamed AL-JĀHĪZ (the goggle-eyed) died in 255-868, being more than 90 years old; he lived at Bassora and wrote among other works a Book of Animals. Scientific evolution at the time of the Abbasides; Life of AL JĀHĪZ; Arabic knowledge of nature. The contents and characteristics of the Book of Animals are given. G. S.

Wiedemann, Eilhard. Über Apotheker und Drogisten zur Zeit der Abbasiden. *Leopoldina*, Heft 56, p. 66-68, Halle a. S. 1920.

1913

Four short notes three of which deal with ZAKARIJĀ AL TAIFŪRĪ.

G. S.

S. X.

Schoy, Carl. Über eine arabische Methode, die geographische Breite aus der Höhe der Sonne im 1. Vertical (« Höhe ohne Azimut ») zu bestimmen. *Annalen der hydrographie und maritimen Meteorologie*, April 1921, 124-133.

1913

Translation of a fragment of the Leiden Arabic Ms. 143 by the Cairene astronomer IBN YŪNUS (d. Cairo 1009). IBN YŪNUS in his Hākemitic tables, — which the author considers the most important work of Arabic astronomy — gives various methods of determining latitude; he determined himself the latitude of Old Cairo with remarkable accuracy (30°). The fragment translated and explained by SCHOY contains a method of determining latitude by the observation of the height of the sun in the first vertical circle at the summer solstice.

G. S.

Schoy, Carl. Abhandlung des ḤASAN BEN AL-ḤUSAIN BEN AL-ḤAITAM über eine Methode die Polhöhe mit grösster Genauigkeit zu bestimmen. *De Zee*, no. 10, jaargang 1920, bdz. 586-601.

1918

This important work of ALHAZEN is translated from a Leyden ms. (catal. cod. orient., III, 94), with prefatory explanation.

G. S.

Schoy, Carl. Abhandlung des AL-ḤASAN IBN AL-ḤASAN IBN AL-ḤAITAM (ALHAZEN) über die Bestimmung der Richtung der Qibla. *Zeitschrift der deutschen morgenländischen Gesellschaft*, t. 75, 242-253, Leipzig 1921.

1913

Translated from the Oxford ms. Selden Arch. A. 34 (= 877, 4° of Catal. cod. orient. bibl. Bodleyana, Oxon, 1787); with a prefatory note explaining the importance of the determination of the *Qibla* (that is, the direction of Mecca). ALHAZEN'S memoir is purely mathematical (not astronomical) and the trigonometrical problem involved is solved in a purely geometrical manner.

G. S.

Wiberg, Jul. The anatomy of the brain in the works of GALEN and 'ALĪ 'ABBAS, a comparative historical-anatomical study. *Janus*, t. 19, p. 17-32, 84-104. Leyde 1914.

1918

This study is based upon the original Greek and Arabic texts of which the author gives us a complete translation followed by a comparison (p. 92-104). The expenses of the translation were defrayed by the « January-Society », the aim of which is to develop intellectual intercourse between Denmark and the countries of W. Europe.

G. S.

S. XI.

Eckleben, Willy. Die abendländischen AVICENNA-KOMMENTARE. (*Diss.*, Leipzig). 23 p. Leipzig 1921.

1918

A list of Western commentaries on the *Canon*, book by book and fen by fen, the editions of each being quoted. There is also a short list of com-

mentaries on other works of AVICENNA. Eastern commentators (of whom there are about 30) are not mentioned. G. S.

Suter, H. und Wiedemann, E. (unter Mitwirkung von O. RESCHER). Ueber AL BIRŪNĪ und seine Schriften. (Beiträge zur Gesch. d. Naturw., 60). *Sitzungsber. d. physik. mediz. Sozietät*, Erlangen, Bd. 52-53, 1920-1921, p. 55-96. 1818

An elaborate account of the life and works of MUḥ. B. AHMED ABŪ RAIḤĀN (or ABU'L RAIḤĀN) AL BIRŪNĪ, born in Sept. 973 in a suburb of Chwārizm (Chiwa) of Iranian stock, died at the end of 1048 in Gazna, Afghanistan. G. S.

Wiedemann, Eilhard. Über die Wage des Wechsels von AL-CHĀZĪNĪ und über die Lehre von den Proportionen nach AL BIRŪNĪ. (Beiträge zur Gesch. d. Naturwiss., 48). *Sitzungsber. d. physik.-medizin. Sozietät*, t. 48-49, 1-15, Erlangen 1918. 1818

Translation of the part of AL BIRŪNĪ's *Kitāb al Tafḥīm* (Book of Instruction) dealing with the theory of proportion and of a part of AL CHĀZĪNĪ's Balance of Wisdom completing the former extract. [AL CHĀZĪNĪ wrote the Balance of Wisdom tables about 515 = 1121-1122]. G. S.

Wiedemann, Eilhard. Magnetische Wirkung nach der Anschauung der Araber. *Zeitschrift für Physik*, 1920, 141-142. 1818

A propos of a passage of the physician and philosopher IBN BUTĀN in which the problem is raised whether the attraction of a piece of iron by a magnet is a love attraction or not. G. S.

Wiedemann, Eilhard. Über Gesetzmässigkeiten bei Pflanzen nach AL BIRŪNĪ. *Biolog. Zentralblatt.*, t. 40, 113-116, 1920. 1818

Very wise rebuke of Christian superstitious ideas, for instance about the shape of a cross in the wood of Paeonia. Also remarks on the symmetry of flowers. G. S.

Zervos, Ch. Un philosophe néoplatonicien du XI^e siècle, MICHEL PSELLOS. Sa vie, son œuvre, ses luttes philosophiques, son influence (*Thèse*) VII + 259 p. Paris, LEROUX, 1919. 1818

S. XII.

Conybeare, F.-C. Four Armenian tracts on the structure of the human body. *Studies in the history of science*, vol. II, 359-384. Oxford, 1921. 1818

From the British Museum Codex Or. 6798; these 4 treatises represent the medical learning of the Armenians not later than the twelfth century. The texts are fully translated. G. S.

Kroner (Rabbiner, Dr.). Eine medizinische MAIMONIDES Handschrift aus Granada. Ein Beitrag zur Stilistik des MAIMONIDES und zur Charakteristik der hebräischen Uebersetzungsliteratur. Im Urtext hrg., übersetzt u. kritisch erl. *Janus*, t. 21, 203-247. Leyde 1916. 1818

[**Nicolaus Praepositus**]. W.-S. VAN DEN BERG. Eene middelnederlandsche vertaling van het *Antidotarium* NICOLAÏ. Met den

latijnsehen tekst der eerste gedrukte uitgave van het *Antidotarium NICOLAI*. Leyde, Brill, 1917. 1813

I know this publication only through a review by M.-A. VAN ANDEL in *Janus*, t. 22, 271-273. The Dutch text (MS. 15624-15641, Bibl. royale, Bruxelles) dates of 1351. Compare with the two French translations of the xivth and xvth cent. published by PAUL DORVEAUX, Paris, 1896. G. S.

Porter, A. Kingsley. La sculpture du xii^e siècle en Bourgogne. *Gazette des Beaux-Arts*, Paris 1921, 22 p. illustrées. 1818

L'auteur discute les deux systèmes contradictoires sur lesquels est fondée la chronologie de l'art roman : l'un, formulé par les archéologues français, est basé sur les monuments; l'autre, qui se fonde sur les documents, est né en Italie et en Espagne. L'auteur défend le dernier système: « L'Art du Moyen Age ne nous a rien laissé de plus beau que la sculpture bourguignonne. » G. S.

Roth, F.-W.-E. Studien zur Lebensbeschreibung der heiligen HILDEGARD (1098-1179). *Studien und Mitteilungen zur Geschichte des Benediktinerordens und seiner Zweige*, Bd. 39, 88-118, Salzburg 1918. 1819

Critical study of the sources and known facts. Important. G. S.

Wiedemann, Eilhard Über die angebliche Beobachtung eines Planeten-durchganges durch AVERROES und andre. *Das Weltall*, J. 20, 180-181, 1920. 1818

S. XIII.

Eneström, Gustav. Sur l'auteur d'un traité *de motu* auquel BRADWARDIN a fait allusion en 1328. *Archivio di storia della scienza*, vol. 11, 133-136, Roma 1921. 1815

Il s'agit du traité dont parle DUHEM dans ses Études sur LÉONARD, 3^e série, p. 292-294. D'après d'autres MSS. étudiés par ENESTRÖM, l'auteur en serait un « Magister GERARDUS de Brussel » (serait-il identique à RICARDUS de Usellis?). ENESTRÖM le place au xiii^e siècle. G. S.

Haskins, Charles-H. The *de arte venandi cum avibus* of the emperor FREDERICK II. *English Historical Review*, July 1921, 334-355. 1818

It is very strange that the main literary work of FREDERICK II has not yet been completely edited. Of the six books, only the first two have been edited: ed. princeps of VELSER, Augsburg, 1596, reprinted with a valuable zoological commentary by J.-C. SCHNEIDER, Leipzig 1788-1789; a poor ed. of a mutilated text. HASKINS' memoir is the first based upon a study of the complete text. It contains a description and criticism of the MSS., divided into two families: a two-book family with additions by King MANFRED and remarkable illustrations and a six-book family without these additions but in which the *lacunae* in books I and II are filled. The Vatican codex (a xivth cent. MS. of the first family) contains more than 900 figures of individual birds admirably done from life. Then HASKINS analyzes the whole work (that FREDERICK himself was the author can no longer be doubted; it was composed c. 1244-1250, probably on or after 1248) and studies its sources. These were of three kinds: systematic treatises on natural history, notably ARISTOTLE; practical treatises on

falconry and the direct observation and personal enquiries of the author. " The first book and earlier chapters of the second have a systematic and a scientific character which give them an important place in the history of mediæval zoology, while the whole treatise is pervaded by the spirit of actual observation and experiment. " May HASKINS' elaborate study hasten the edition of this very important work! G. S.

Henricus Dacus (Henrik Harpestreng). De simplicibus medicinis laxativis. Publié par J.-W.-S. JOHNSON. *Janus*, t. 22, 27-55, 61-114, 2 pl., Leyde 1917. ISIS

With commentary, notes and comparison between the Latin DACUS text and the Danish HARPESTRENG text which are shown to be entirely equivalent. This publication is a translation of the Danish edition of 1914 (*Isis*, IV, 13). G. S.

Jäger, Fritz. Zahnärztliches aus den Werken ALBERTS DES GROSSEN und seiner Schüler THOMAS VON CANTIMPRÉ und VINCEZ VON BEAUVAIS (*Diss.*, Institut f. Gesch. d. Medizin, Leipzig), 63 p. Mannheim 1921. ISIS

Manly, John-M. The most mysterious manuscript in the world. Did ROGER BACON write it and has the key been found? HARPER'S Magazine, vol. 143, p. 186-197, 5 illustrations. New York, July 1921. ISIS

A propos of the MS. brought to light by WILFRED M. VOYNICH, the bookseller, in 1912 and of which Prof. WILLIAM ROMAINE NEWBOLT of the University of Pennsylvania claims to have discovered the secret. This MS. is ascribed to ROGER BACON. It is a small volume ($8\frac{1}{2} \times 5\frac{3}{4}$ in.) on vellum, containing originally 272 p. (26 p. have been lost), illustrated with coloured drawings (" plants, leaves and roots, astrological diagrams, realistic and symbolical representations of cell development, strange pictures of nude women "), written in cipher. A letter is attached to it, written by JOH. MARCUS MARCI in 1665 when he presented it to ATHANASIVS KIRCHER. Apparently the MS. once belonged to the Emperor RUDOLF and was believed by members of the court circle to be ROGER BACON'S work. It is possible that RUDOLF had received it from JOHN DEE. The MS. is apparently a medical treatise, but then why such secrecy? Prof. NEWBOLT explained the cipher before the College of Physicians of Philadelphia and the American Philosophical Society in April. He has already deciphered in it astronomical observations and predictions, scientific theories, historical facts (*ex. gr.* the account of a riot in Oxford on Feb. 27, 1273). The MS. would prove that BACON used a telescope and a simple microscope, and the discovery of many biological and embryological facts could be ascribed to him (seminiferous tubes, cells with nuclei, spermatozoa!). This has been studied by Prof. McCLUNG, the histologist. According to some other enthusiast, the drawings suggest the use of a compound microscope (magnification, 75!) — NEWBOLT'S system of decipherment is so flexible that it is untrustworthy, for " absolute certainty of interpretation is one of the first essentials of a good cipher ". MANLY discusses NEWBOLT'S system and is rather sceptical about it. I share fully his scepticism. G. S.

Steele, Robert. ROGER BACON and the state of science in the thirteenth century. *Studies in the history and method of science*, vol. 2, 121-150, Oxford 1921. ISIS

A general study of BACON'S work with special reference to his environment. " ROGER BACON stands out prominently as the first English leader

of scientific thought... In his works we can trace the process of emancipation from established ruts of thought and the entrance of new conceptions. We can follow his attempts to make a theory explain the whole body of natural phenomena, the gradual elaboration of a mathematical theory of action at a distance, which, unfruitful at the moment, reappears in a fuller form in modern science. We see him as a pioneer of textual criticism, a critic of established authorities... The work of such a one should be available to all the world of scholars : more than half of it in bulk is still locked up in single MSS. difficultly legible and almost inaccessible "...

G. S.

Thomas, Antoine. JEAN PITART, chirurgien et poète. *Janus*, t. 22, 279-293. Leyde 1917. 1818

Thomas, Antoine. JEAN PITART, chirurgien et poète. *Comptes rendus de l'Académie des inscriptions*, Paris 1916, p. 95-111. 1818

Sa vie; ses écrits : 1. Le recueil de recettes médicales qui lui est attribué est l'œuvre d'un compilateur postérieur; 2. Le *Dit de Bigamie*. — PITART est le premier chirurgien français qui ait jeté de l'éclat sur sa profession, mais sa renommée est appuyée sur bien peu de chose. Il n'est aucunement prouvé qu'il ait vraiment fondé le Collège de Chirurgie de Paris en 1271, ni que LANFRANC y ait été reçu en 1295. Le premier document authentique relatif à PITART date de 1292; il n'est pas mort en 1315, mais au plus tôt en 1327 ou 1328.

G. S.

Wickersheimer, Ernest. Les origines de la faculté de médecine de Paris; sa situation dans l'université naissante. *Bull. Soc. franç. hist. méd.*, t. 13, 249-260. Paris 1914. 1818

" Si l'on fait abstraction des témoignages de GILLES DE PARIS et de GUILLAUME LE BRETON, c'est dans un mandement épiscopal daté de 1213 qu'il faut chercher la trace la plus ancienne d'un enseignement médical dans l'université de Paris "...

G. S.

Wickersheimer, Ernest. Maître HENRI DE DANEMARK, médecin à Orléans sous le règne de PHILIPPE-AUGUSTE. *Bull. Soc. franç. hist. méd.*, t. 14, 243-245, Paris 1920. 1818

Il s'agit sans doute du même personnage que HENRICUS DACUS, alias HENRIK HARPESTRENG, étudié par J.-W.-S. JOHNSON (*Isis*, IV, 13).

Wiedemann, Eilhard. Über die Kriechtiere nach AL QAZWINI nebst einigen Bemerkungen über die zoologischen Kenntnisse der Araber. (Beitr. zur Gesch. d. Naturw., 53). *Sitzungsber. d. physik. mediz. Ges.*, t. 48, 228-285, Erlangen 1918. 1818

See below under Islam, p. 431.

G. S.

Wiedemann, Eilhard. Übersetzung und Besprechung des Abschnittes über die Pflanzen von QAZWINI (Beitr. zur. Gesch. d. Naturwiss., 54). *Sitzungsber. d. physik. mediz. Gesellschaft*, t. 48, 286-321. Erlangen 1918. 1818

Translation with commentary of the text published by WÜSTENFELD, Bd. 1, 245-301.

G. S.

Wiedemann, E. und Hauser, F. Über eine Palasttüre und Schlösser nach AL GAZARI. *Der Islam*, t. 11, 213-251, 1921. 1818

This study is based on a part of the last domain (nau') of GAZARI's work

on the knowledge of geometrical, ingenious (mechanical) contrivances, composed in 1205-1206. WIEDEMANN and his friends have now placed this whole work within the reach of non-Arabic scholars (a list of their previous studies will be found on p. 214). See *ex. gr.*, *Isis*, III, 324, 478.

G. S.

Wiedemann, Eilhard. Beschreibung von Schlangen bei IBN QAFF. (Beitr. zur Gesch. d. Naturw., 50). *Sitzungsber. d. physik. medicin. Societät*, t. 48-49, p. 61-64, Erlangen 1918. 1818

Translation with commentary of the chapter on snakes in the *Gāmi' al Garad fi Hifz al Sihha wa Daf' al Marad* (Compendium of what one should know to preserve one's health and avoid disease) by ABU'L FARAG IBN JA'QUB, usually named IBN QAFF (or IBN al QUFF) al Masīhī (the Christian), who died in 685=1286. G. S.

S. XIV.

Battistini, Mario. Note d'archivio. *Archivio di storia della scienza*. Vol. 2, 211-214, Roma 1921. 1818

1. Un medico del carcere di Firenze nel sec. XIV (ANDREA DI BARTOLO); 2. Maestro GREGORIO DA PISA, oculista del sec. XIV, condotto a Firenze; 3. Maestro BELTRAMO DA CORTONA, medico oculista a Firenze nel sec. XIV; 4. La condanna e la grazia di Maestro STEFANO DEGL' IMPIASTRI nel 1341; 5. Maestro CRISTOFANO DEI BRANDAGLINI di Firenze (fl. at the end of S. XIV). G. S.

[Hāfiz]. Selections from the Rubaiyāt and Odes of HĀFIZ. Collected from many old Persian manuscripts and rendered into English verse by a member of the Persia society of London. Together with an account of Sūfi mysticism. 147 p. London, WATKINS, 1920. 1818

Krause, F.-C.-A. Das Mongolenreich nach der Darstellung des Armeniers HAITHON. HIRTHS Festschrift, Berlin 1920, 238-267. 1818

A propos of HAITHONI ARMENI *historia orientalis : quae eadem et de Tartaris inscribitur*, that is, the relation dictated by HAITHON the younger to Brother NIC. SALCONI in French, and translated by the latter into Latin by order of Pope CLEMENT V, A. D. 1307. G. S.

Loria, Gino. DANTE (1) e la scienza del suo tempo. *Conferenze e Proslusioni*, anno XIV, 193-202. Torino 1921. 1818

A lecture delivered at the University of Genoa in April 1921 and divided as follows : scientific character of the *Commedia*; the importance of number in this poem; DANTE's mathematical knowledge; DANTE as a naturalist; his travels; his astronomical knowledge; astrology; DANTE and modern science. G. S.

Passerini, Giuseppe Lando (*editor*). Le vite di DANTE, scritte da GIOVANNI e FILIPPO VILLANI, da GIOVANNI BOCCACCIO, LEONARDO ARETINO e GIANNOZZO MANETTI, ora novalmente publicate con introduzione e con note. XLVIII + 292 p. Firenze, SANSONI, 1917. 1818

(1) Henceforth, I will put the DANTE literature under S. XIV (instead of S. XIII as I did before), because DANTE's works were accomplished in the beginning of the thirteenth century. (*Isis*, IV, 137). G.S.

Sagher, De. Note concernant l'année de la mort de JAN YPERMAN. *Janus*, t. 19, 33-34, Leyde 1914. 1818

From documents in the archives of Ypres (now presumably destroyed), it would appear that YPERMAN died between Oct. 28, 1330 and Nov. 1, 1331. G. S.

Scheffer, Hans. Ein therapeutischer *Thesaurus pauperum* des 14. Jahrhunderts in lateinischen Versen nach einer Leipziger und zwei Münchener Handschriften. (Diss., Leipzig; Institut f. Gesch. d. Medizin). 31 p. Leipzig 1921. 1818

The best known medical compilation of the Middle Ages is the *Regimen Sanitatis Salernitanum* dating of the beginning of the xivth century. There are many other poems of the same time more or less different from the Salernitan collection (see SUDHOFF, *Archiv. f. Gesch. d. med.*, XII, 149) and the *Thesaurus pauperum* is one of them. It is here edited on the basis of three MSS., of which the oldest (Monacensis 251) dates of the second half of the xivth cent. and contains 500 verses. — The text is followed by a short commentary and an index of the drugs mentioned. G. S.

Toynbee, Paget. Britain's tribute to DANTE in literature and art. A chronological record of 540 years (c. 1380-1920). The British Academy (DANTE commemoration 1921). xvi + 212 p. London, Milford 1921. 1818

A chronological bibliography with two indexes : I. Literature; II. Art. This is not a critical bibliography, for there are but few critical notes; yet it may prove useful. G. S.

Wiedemann, Eilhard. Über den Abschnitt über die Pflanzen bei NUWAIRI. (Beitr. zur Gesch. d. Naturw., 51). *Sitzungsber. d. physik. medicin. Gesell.*, t. 48, 151-176, Erlangen 1918. 1818

Transl. from the part of AL NUWAIRI's great encyclopædia dealing with plants, with commentary. For a translation of the part dealing with drugs, see below under Islam (p. 431). G. S.

S. XV.

[**Amirdolvathe d'Amassie**]. Tini-Maghtum traduit du texte arménien de l'ouvrage D'AMIRDOLVATHE (D'AMASSIE), médecin arménien du xv^e siècle, par VAHRAM II. TORKOMIAN. *Janus*, t. 20, 109-112, Leyde 1915. 1818

Tini-maghtoum (ou dini-mahtoum); en arménien, matnéhar-gav; en persan, guili-maghdoum; en italien, terra sigillata. G. S.

Seybolt, Robert Francis. *The Manuale Scholarium*. An original account of life in the mediæval university. 122 p. Cambridge. Harvard University Press, 1921 [\$ 1.50]. 1818

The *Manuale*, the author of which is unknown, first appeared in 1481, and was frequently re-edited in the xvth and xvith centuries. It is our chief source of information on student life in the xvth century in German universities, more particularly Heidelberg, and has been used extensively by all writers on mediæval education. It consists of a series of dialogues between two students on the main topics of interest to them (their initiation, exercises, lectures, amusements, women, quarrels, etc.). Judging from the few passages I have been able to check, the translation

in colloquial English corresponding to the colloquial Latin, is excellent (it is the first complete translation in any modern language). The translator has added elaborate explanations in the introduction and the footnotes and a few typical statutes selected from the codes of Erfurt, Heidelberg and Leipzig, in an appendix. This translation makes excellent reading though it is not as racy as the Latin original. G. S.

Sudhoff, Karl. Nochmals Dr. CORNELIS ROELANTS von Mechelen, der von ihm benutzte frühmittelalterliche Leitfaden für die Kinderpraxis und ein pseudo-GALENUS *de passionibus puerorum* aus der Spätantike. *Janus*, t. 20, 443-458, Leyde 1915. 1818

CORNELIS ROELANTS, graduated as M. D., Louvain 1488, a physician of renown in 1497, d. 1525. G. S.

Bilancioni, Guglielmo. A proposito de « L'orecchio e il naso nel sistema antropometrico di LEONARDO DA VINCI ». *Archivio di storia della scienza*, vol. 2, 250-253, Roma 1921. 1818

Discussion of GIUSEPPO FAVARO's unfriendly criticisms of his book (see *Isis* IV, 141). G. S.

Hopstock, H. LEONARDO as anatomist, translated from the Norwegian by E.-A. FLEMING. *Studies in the history and method of science*, vol. 2, 151-191, with illustr. Oxford 1921. 1818

For the original memoir, see *Isis* III, 331. It is a general survey of the subject by one of the editors of the *Quaderni*. G. S.

Lorenzo, Giuseppe de. LEONARDO DA VINCI e la Geologia. (Pubblicazioni dell' istituto vinciano in Roma, III), 197 p. Bologna 1920. [L. 15]. 1818

This book is not on the same level as VENTURI'S (see below); indeed, it is disappointing. We expected to find a comprehensive and sober account of LEONARDO'S ideas on geology, but we are given instead the most discursive dissertation imaginable. Only 59 pages are devoted to Leonardo, and even then the author finds it difficult to stick to his subject! The rest is an amazing hotchpotch. LORENZO'S frequent references to Buddhist literature, if not strictly relevant, are interesting. MARIO BARATTA'S account was more modest but far more satisfactory. G. S.

McMurrich, J. Playfair. LEONARDO DA VINCI. The artist. *Queen's Quarterly*, vol. 28, 402-418. Kingston, Queen's University, 1921. 1818

A lecture delivered before the Women's Art Association of Toronto, Jan. 1921. G. S.

Regnault, Félix. Les dessins de LÉONARD DE VINCI. *Bull. soc. franç. hist. méd.*, t. 13, p. 478-488. Paris 1919. 1818

Leur réalisme : les édentés, représentation du syndrome oxycéphalique, etc. G. S.

Vasari, Giorgio. La vita di LEONARDO DA VINCI. Nuovamente commentata e illustrata con 200 tavole a cura di GIOVANNI POGGI. 63 p. + 200 pl. + LXXVII p. Firenze, LUIGI PAMPALONI, 1919. 1818

Venturi, Adolfo. LEONARDO DA VINCI pittore (Pubblicazioni dell' Instituto Vinciano in Roma, II), 197 p., 129 fig. Bologna 1920. [L. 35]. 1918

The first vol. of this collection, by LIONELLO VENTURI, dealt with LEONARDO's theories of art (*Isis* III, 458). The present one by the great historian of Italian art is as good as we expected, and our expectations were high. It is perhaps the best general account of LEONARDO the Artist available to-day. The method of presentation is excellent: I. Notizie storiche sulle pitture di L. (61 p.); II. Le opere pittoriche di L. (65-141); III. Regesti dell'opera pittorica di L. (that is, a chronology *raisonnée*, very elaborate). The illustrations are excellent. G. S.

S. XVI.

Blok, P.-J. REMBERT DODOENS, protestant? *Janus*, t. 22, 269-270. Leyde 1917. 1918

Ses sympathies étaient plutôt catholiques, mais il était « de la religion d'ÉRASME ». G. S.

Cumston, Charles Greene. The finances of FELIX PLATTER, professor of medicine at Bale. *Annals of medical history*, t. II, 265-266. New York 1921. 1918

FELIX PLATTER (b. Bale 1536, d. 1614), professor of medicine at the Bale university, physician (*archiater*) of the city, founder of a museum of natural history, as well as the botanical garden of the university. G. S.

[**Diez, Juan**]. The *Sumario Compendioso* of Brother JUAN DIEZ. The earliest mathematical work of the new world by DAVID EUGENE SMITH. 65 p. Boston, GINN, 1921. 1916

A facsimile reproduction of the earliest mathematical work printed in the Americas, with translation on the opposite pages and a learned introduction. The *Sumario* appeared in Mexico city in 1556 (printing began there in 1536). JUAN DIEZ was a native of Galicia, a companion of CORTEZ, the editor of JUAN DE AVILA (the apostle of Andalusia) and of the *Itinerario* of the Spanish fleet to Yucatan in 1518. His book was published chiefly to assist the buyers of gold and silver in their computations; that is, it is a book of the same class as the *Tariffa de pezi e mesure* by ANT. BART. DI PAXI, Venezia 1503 or the *Tariffa perpetua* by GIOV. MARIANI, *ibidem*, 1535. Of the tables only one page is reproduced, but the arithmetical and algebraical parts are reproduced *in extenso*. The six pages of algebra are especially interesting (CARDAN's *Ars Magna* had appeared only in 1545) — No other mathematical book was published in Mexico in the xvth cent., except for a brief *Instrucción Nautica*, 1587. G. S.

Dodoens, Rembert (Malines, Belgium, June 29, 1517 — March 10, 1585). A whole number of *Janus*, t. 22, p. 141-204, Leyde 1917, was devoted to him to celebrate the fourth centenary of his birth. It contains an introductory editorial by E.-C. VAN LEERSUM and the following essays: F.-W.-T. HUNGER. D. comme botaniste; M.-A. VAN ANDEL. D. and his influence on Flemish and Dutch folk-medicine; J.-G. DE LIST. Les portraits de D. (2 illustr.); M.-J. SIRKS. L'herbier flamand de D. G. S.

Dorveaux, P. La botanique dans les « Satyres chrestiennes de la cuisine papale ». *Janus*, t. 21, 149-166, Leyde 1916. 1813

Les « Satyres chrestiennes » : un pamphlet huguenot anonyme, dont la 1^{re} éd. parut chez CONRAD BADIUS à Genève en 1560. G. S.

Favaro, Antonio. GALILEO GALILEI in una rassegna del pensiero italiano nel corso del secolo decimosesto. *Archivio di storia della scienza*, vol. II, 137-146, 1921. 1813

A learned essay suggested by : ROGER CHARBONNEL. La pensée italienne au xvi^e siècle et le courant libertin. Paris 1919, with a most interesting prefatory statement on the work of P. DUHEM. G. S.

Foster, William (editor). Early travels in India (1583-1619). xiv + 351 p., 10 illustr. Oxford University Press, 1921. 1813

This collection of early travels reprinted from various older editions includes the reports of all the travellers of importance who visited N. and W. India under the reigns of AKBAR and JAHANGIR, except Sir THOMAS ROE. That is : RALPH FITCH, 1583-1591; JOHN MILDENHALL, 1599-1606; WILLIAM HAWKINS, 1608-1613; WILLIAM FINCH, 1608-1611; NICHOLAS WITHERINGTON, 1612-1616; THOMAS CORYAT, 1612-1617; EDWARD TERRY, 1616-1619. The editor of this collection is already well known because of his great work on the English factories in India, a calendar of documents from 1618 to 1660, 10 vol., 1906-1921. G. S.

Hellweg, Heinrich. Die Lehre des BARTOLOMEO EUSTACHI über Bau und Entwicklung der Zähne (*Diss*, Institut für Gesch. d. Medizin). 38 p. Leipzig 1921. 1818

Hemmeter, John C. MICHAEL SERVETUS (1511-1553). Discoverer of the pulmonary circulation. His life and work. *Janus*, t. 20, 331-364, 9 pl. Leyde 1915. 1818

Includes a bibliography and 9 valuable illustrations (title pages, monuments, portrait) loaned by Sir WILL. OSLER. G. S.

Holl, Moriz und Sudhoff, Karl. Des ANDREAS VESALIUS sechs anatomische Tafeln vom Jahre 1538 in Lichtdruck neu herausgegeben. Folio, 12 p., 6 facsimile pl. Leipzig, BARTH, 1920. 1813

A splendid facsimile reproduction of the little school-atlas published by VESALIUS in Venice 1538, that is, five years before the *Fabrica*. VESALIUS received the assistance of JAN STEPHAN VAN CALCAR, who probably drew the skeleton of the last 3 plates. This atlas was published by VESALIUS during the first year of his teaching in Padova; it was used so extensively that only two copies of it are known to exist : one in San Marco, Venice; the other in WILLIAM STIRLING-MAXWELL'S collection. The latter published a facsimile ed. of his copy in 1874. The present edition is a facsimile of the San Marco copy; 3/4 of the original size. It is preceded by a historical introduction by SUDHOFF, and an elaborate description of each plate by the late M. HOLL (1852-). G. S.

Leclerc, Henri. L'art d'obtenir des fruits laxatifs d'après ANTOINE MICHAUD. *Bull. soc. hist. méd.*, t. 15, 121-124. Paris 1921. 1818

A propos de l'*Aleacikepus* d'ANTONIUS MISALDUS, traduit en français par ANTOINE CAILLE, 1578; exposé d'une méthode pour donner des propriétés médicamenteuses à des fruits par injection dans la plante vivante ou par greffe. G. S.

Montgomery, Douglas W. The quintessence in RABELAIS. *Annals of medical history*, II, 330-333, New-York 1919. 1818

Paoli, Humberto Julio. Il libro di GARCIA DA ORTA. Contributo alla storia della scienza lusitana. *Archivio di storia della scienza*, vol. II, 202-210, Roma 1921. 1818

Important bibliographical study of GARCIA DA ORTA'S famous book, *Coloquios dos simples e drogas he cousas medicinaes da India...* Goa, 1563, which has been studied in *Isis* (II, 415) apropos of Sir CLEMENTS MARKHAM'S translation. G. S.

Rosenbloom, Jacob. Statements of medical interest from the life of BENVENUTO CELLINI (1500-1571). *Annals of medical history*, II, 348-366. New York 1919. 1818

Ruhrāh, John. THOMAS PHAER. *Annals of medical history*, II, 334-347. New York 1919. 1818

THOMAS PHAER (1510?-1560), physician, the father of English pediatrics, the author of *The Booke of Chyldren*, translator of the *Aencid*, 1584. G. S.

Schelenz, Hermann. Geheimlehren. Dämonologie bei SHAKESPEARE. *Janus*, t. 20, 155-173. Leyde 1915; t. 21, 1-26, 1916; t. 22, 1-26, 239-268. 1818

[Vésale, André]. A whole number of *Janus*, t. 19, p. 397-523, Leyden 1914, was devoted to him apropos of the fourth centenary of his birth. It contains an introductory article by E.-C. VAN LEERSUM and the following memoirs: J.-G. DE LINT. Les portraits de V.; L. KNAPPERT. L'église et la science au temps de V.; F.-M.-G. DE FEYFER. Die Schriften des V. (this is the most important contribution, p. 435-507, an elaborate bibliography of V.'s writings, including the apocryphal, with an iconographical study and a separate index); J. BOKKE. V. comme réformateur de l'anatomie; J.-J. VAN DER KLEIJ. Von wo stammen die Vorfahren von V. her? G. S.

Wagner, Hermann. Die Legende der Längenbestimmung AMERIGO VESPUCCI'S nach Mondabständen (23. Aug. 1499). *Nachrichten d. Kgl. Ges. d. Wiss., math. physik. Klasse*, J. 1917, 264-298. 1818

VESPUCCI is not the inventor of the determination of longitudes by means of lunar distances, for the letter upon which this claim rested is apocryphal. This method was unknown in the xvth century. G. S.

Wickershelter, Ernest. Une gravure anatomique de JOBST DE NECKER (1538). *Bull. soc. hist. méd.*, t. 15, 114-118, Paris 1921. 1818

S. XVII.

Bachmann, Paul. Das FERMAT-problem in seiner bisherigen Entwicklung, VIII + 100 p., Berlin, Vereinigung wissenschaftl. Verleger, 1919. 1818

[Bartholinus, Thomas. 1616-1680]. A whole number of *Janus*, t. 21, p. 271 to 378, Leyde 1916 was devoted to him to celebrate the tercentenary of his birth. It contains a general study by V. MAAR

and the following : B. and archaeological researches in Denmark in the xviii cent. by C. NEERGAARD; Quelques lettres de B. à OLAUS WORM, éditées par J.-W.-S. JOHNSON; Sur les portraits de B. par O. ANDRUP (p. 324-338; plusieurs portraits sont reproduits); The *domus anatomica* at the time of B. by V. MAAR; A memorial tablet lost and found by same; A few remarks about B. 's life in the country by A. GARBOE (with views of the manor Hagedsted or Hagedstedgaard, where B. settled in 1660, which was destroyed by fire in 1676 — with B. 's library —, which he rebuilt and where he died in 1680); Les nobles B. par A. THISET; The B. family by K. CARÖE; La famille des B. par C.-T. BARTHOLIN (there are few descendants of B. in Denmark, but many more in Chili); Quatre lettres de B. par P.-C. MOLHUYSEN. G. S.

Bigourdan, G. Sur diverses stations astronomiques françaises du xvii^e siècle. *Comptes rendus de l'Académie des sciences*, t. 166, p. 269-275. Paris 1918. 1818

Other notes on French astronomy in the xviii cent. and later will be found in the *Comptes-rendus*, passim. I do not quote them individually for they are merely of local interest and will be, I understand, reprinted in book form. G. S.

Boulenger, Jacques. The seventeenth century. London, HEINEMANN; New-York, PUTNAM, 1920. 1818

Translation of "Le grand siècle", published by HACHETTE in 1911. G. S.

Castiglioni, Arturo. La vita e l'opera di SANTORIO SANTORIO CAPODISTRIANO (1561-1636). 86 p., illustr. Bologna, L. CAPPELLI, 1920. [L. 5]. 1818

A short biography, but complete, well-informed, well thought out and agreeably written. An up-to-date bibliography makes it easy to find whatever additional information may be needed. SANTORIO's work was of the greatest importance and well might BOERHAAVE say of his *de statica medicina* (1614): "Nullus liber in re medica ad eam perfectionem scriptus est". The author analyzes briefly the *statica* and also the minor writings and discusses the introduction of clinical instruments by SANTORIO. An excellent little book. G. S.

Daniels, C.-E. Beiträge zur Geschichte der Geburtshilfe. III. *Janus*, t. 21, 167-181, portrait, Leyde 1916. 1818

Devoted to the Swedish obstetrician JOHAN VAN HOORN, born of Dutch parentage in Stockholm 1631, author of "Then swenska wälöfwada jordegumman" (the well-trained Swedish midwife) 1697, died Stockholm 1724. — For other studies by DANIELS, see under S. XVIII. G. S.

Del Lungo, Carlo. Del pendolo e della sua applicazione all'orologio. *Archivio di storia della scienza*, vol. II, 147-166, Roma 1921. 1818

A careful study of the discovery of the pendulum, of the law of isochronism of the small oscillations, of the relation between the length of the pendulum and its period and of its first application to clockmaking, — chiefly to vindicate GALILEO against the malicious attacks of CAVERNI (see *Isis* III, 493). G. S.

Fahie, J.-J. The scientific works of GALILEO (1564-1642) with some account of his life and trial. Being a review of Favaro's *Edizione nazionale delle Opere di GALILEO* (1890-1909). *Studies in the history and method of science*, vol. II, 206-284, illustr. Oxford 1921.

1818

Goulard, Roger. A propos de l'affaire des poisons; Le célèbre édit de 1682. *Bull. soc. franç. hist. méd.*, t. 13, 260-268. Paris 1914.

1818

Graeven, Hans (1866-1905). *LEIBNIZENS Bildnisse*. Vervollständigt und hrg. v. CARL SCHUCHHARDT. Mit 24 Tafeln. *Abhdl. d. kgl. preuss. Akad. d. Wiss., philosophisch-histor. Klasse*, J. 1916, Nr. 3. 80 p. Berlin 1916.

1818

Die Aufdeckung der Gebeine von L.; die Überlieferung über die Bildnisse; die erhaltenen Oelgemälde; die Kupferstiche; die Büsten; Ergebnis; beschreibendes Verzeichnis der sämtlichen Bildnisse — 56 different portraits are reproduced.

G. S.

Hervey, Mary F.-S. (1853-1920). The life, correspondence and collections of THOMAS HOWARD, earl of ARUNDEL. [1585-1646] XXXII + 652 p., Cambridge University Press, 1921.

1818

Lang, Robert. JOHANN CONRAD PEYER, *Janus*, t. 19, p. 61-83, Leyde 1914.

1818

Physician of Schaffhausen, b. 1653—d. 1712, described the follicles of the intestine.

G. S.

Leclerc, Henri. La liqueur anti-varioleuse de WALDSCHMIDT et DOLOEUS. *Bull. soc. franç. hist. médec.* t. 14, 239-245, Paris 1920.

1818

Il s'agit de la *liquor contra variolas* ou *antivariolosus* inventée par le médecin allemand WALDSCHMIDT et dont il parle dans ses lettres à JEAN DOLOEUS en 1687. Il semblerait que ce remède secret était simplement du thé...

G. S.

Leclerc, Henri. Un remède de GUY PATIN : le sirop de roses pales. *Bull. soc. hist. méd.*, t. 15, 212-216, Paris 1921.

1818

Leersum, E.-C. van. Trois lettres de JEAN CONRAD PEYER. *Janus*, t. 21, 111-128, 1 pl. Leyde 1916.

1818

Trois lettres de J.-C. PEYER (Schaffhausen 1653-1712) à son compatriote suisse JEAN-JACQUES WEMPFER dont les archives et la bibliothèque furent acquises par la Faculté de médecine de Leyde vers la fin du XVIII^e siècle. Ces lettres sont datées de Genève 1677, Paris 1677-1678 et traitent des questions d'anatomie.

G. S.

[**Leibniz**]. Neun Briefe von LEIBNIZ an FRIEDRICH AUGUST HACKMAN, von PAUL RITTER. *Sitzungsber. d. kgl. preuss. Akad. d. Wiss.*, J. 1915, p. 714-730. Berlin 1915.

1818

Loghem, J.-J. van. The plague of the XVIIth century compared with the plague of our days. *Janus*, t. 23, 95-107. Leyde 1918.

1818

Lundsgaard, K.-K.-K. BORRI, THOMAS BARTHOLIN, HENRIK SKRIVER. *Janus*, t. 23, 41-47, Leyde 1918.

1818

Apropos of the experiment shown by BORRI to OLE BORCH in Amsterdam

before 1667 : BORRI cut through the cornea of an animal, pressed all the humors out of the eye, and instilled a fluid invented by himself, after which the eye refilled itself and the animal was able to see. G. S.

Moutier, François et Villaret, Maurice. A propos des atlas anatomiques à planches superposées. *Bull. soc. hist. méd.*, t. 15, 119-121, Paris 1921. 1818

Il s'agit des trois atlas suivants : JEAN REMMELIN, Augsburg 1619; MICHEL SPACHER, Amsterdam 1634 (SPACHER était un collaborateur de REMMELIN); J. REMMELIN, Francfort 1660. G. S.

Peachey, G.-C. The two JOHN PEACHEYS, seventeenth century physicians, their lives and times. *Janus*, t. 23, 121-158, Leyde 1918. 1818

JOHN PECHY, M.-A. Oxon., Licentiate of the College of Physicians (1654-1718); JOHN PEACHIE, M.-D. Caen, *extra-urbem* licentiate of the College of Physicians (? 1632-1692). Very elaborate biographies. G. S.

Rambaud, Pierre. La bibliothèque d'un médecin de Poitiers au XVII^e siècle. *Bull. soc. franç. hist. méd.*, t. 14, 98-102. Paris 1920. 1818

Roy, Pierre Georges. Un hydrographe du roi à Québec. JEAN-BAPTISTE-LOUIS FRANQUELIN. Mémoires et comptes rendus de la Société royale du Canada, t. 13, section I, p. 47-59, 1920. 1818

Le dit FRANQUELIN naquit entre 1651 et 1653 à Saint-Michel de Villebernin, près Bourges, il vécut dans la Nouvelle France et mourut en France entre 1712 et 1730. L'auteur énumère les vingt cartes américaines levées par lui; elles sont datées de 1678 à 1708. G. S.

Ruhräh, John. WALTER HARRIS, a seventeenth century paediatrist. *Annals of medical history*, t. II, 228-240, New York 1919. 1818

HARRIS was born in 1647 (not 1651) at Gloucester, England. "HARRIS was not a great physician, not a master mind, not an original thinker, but he wrote a good book that held its place a hundred years; he was a shrewd and honest practitioner; a keen observer, particularly of the action of drugs, which led him to teach simplicity, caution and common sense". The "good book" is his *de morbis acutis infantum*, Amsterdam 1689, of which many extracts are quoted. G. S.

Slaby, A. OTTO VON GUERICKE. Fest-Vortrag aus Anlass der Grundsteinlegung des Deutschen Museums gehalten im Wittelsbacher-Palais in München am 13. Nov. 1906. Deutsches Museum, *Vorträge und Berichte*, Heft 3, 13 p., 2 pl. 1818

With GUERICKE's portrait painted by CLAUD MEYER and a reproduction of his original airpump given by the University of Berlin to the Museum. G. S.

Stefanini Giuseppe. Spigolature Cestoniane. *Archivio di storia della scienza*, vol. II, 215-221, Roma 1921. 1818

Notes completing the biography of the naturalist DIACINTO CESTONI (1637-1718) published by the author in *Gli scienziati italiani*, I, 122-127.

Sieda, Wilhelm. Professor FRIEDRICH LEUBNITZ, der Vater des Philosophen. *Berichte d. Sächs. Ges. d. Wiss., phil. Kl.*, 69 Bd., 35 p., 3 pl., 3 facsim. Leipzig 1917. 1818

An elaborate notice on FRIEDRICH LEUBNITZ (*sic*), Altenberg 1597. Leipzig

1652, the father of the great LEIBNIZ. He was professor of morals at the University of Leipzig. Three portraits; documents. G. S.

Tandberg, J. -G. Die Triewaldsche Sammlung am physikal. Institut der Universität zu Lund und die original Luftpumpe GUERICKE'S. *Lunds Universitets Arsskrift. Avd. 2. Bd. 16, 4^o, 31 p.*, Lund 1920.

1818

MARTEN TRIEWALD (1691-) after a ten years' residence in England returned in 1726 to Sweden with a rich collection of scientific instruments. In 1732, TRIEWALD's collection was presented to the Lund Akademie by TRIEWALD's former assistant, DANIEL MENLÖS. The catalogue of 1732 here reproduced (in Swedish) contained 327 items, of which only a few remain; among them happily one of GUERICKE's original air pumps. TANDBERG provides a careful description of this pump and a history of other Guerickeian pumps. G. S.

Villaret, Maurice et Moutier, François. La paracentèse abdominale au xvii^e siècle. *Bull. soc. franç. hist. méd.*, t. 14, 173-178. Paris 1920.

1818

S. XVIII.

Amodeo, Federigo Un' applicazione del teorema di NICOLA DE MARTINO sulle volte a padiglione. *Bollettino di matematica*, anno xvii, 2 p. Bologna 1921.

1818

A propos of a mathematical theorem included in N. DE MARTINO. *Elementi di Geometria...* 3 vol., Napoli 1768, vol. II, 196. G. S.

Avalon J. Une diatribe de RESTIF DE LA BRETONNE (1734-1806) contre les médecins. *Bull. soc. hist. méd.*, t. 15, 169-181. Paris 1921.

1818

Publiée en 1774 dans les « Nouveaux mémoires d'un homme de qualité », pour défendre son ami le D^r GUILBERT DE PRÉVAL, l'inventeur d'un spécifique infaillible contre la syphilis. G. S.

Boerhaave Herman. (Voorhout, nr. Leyde 1668, Dec. 31 — Leyde, 1738, Sept. 23). A whole number of *Janus*, t. 23, p. 193 to 369, Leyde 1918, has been dedicated to him because of the 250th anniversary of his birth. After an editorial introduction by E.-C. VAN LEERSUM follow : W.-P.-C. ZEEMAN. B. et l'oculistique; MAX NEUBURGER. B.'s Einfluss auf die Entwicklung der Medizin in Oesterreich; ERNST COHEN. B. und seine Bedeutung für die Chemie (p. 223-290); J.-E. KROON. B. as Professor-Promotor; E.-C. VAN LEERSUM. Cours de B. en particulier ses leçons cliniques. Description de l'héritage sténographique laissé par GERARD VAN SWIETEN (plusieurs facsim.); F.-W.-T. HUNGER. B. comme naturaliste; J.-G. DE LINT. Les portraits en gravure de B.; W. MARTIN. Das Bildnis B.'s von AERT VAN GELDER (1722). G. S.

Bonnet, Ed. Procès-verbaux constatant la guérison de deux femmes atteintes de maladies vénériennes traitées par GUILBERT DE PRÉVAL (1773). *Janus*, t. 21, 406-409, Leyde 1916 (reprinted *ibidem*, t. 23, 29-32, 1918 !)

1818

Burr, Charles W. JEAN-PAUL MARAT, physician, revolutionist, paranoiac. *Annals of medical history*, t. 11, 248-261. New York, 1919.

1818

Cumston, Charles Greene. The legal control of the sale of nostrums and poisons in France during the eighteenth century *Annals of medical history*, II, 396-399, New York 1919. 1818

Dahlgren, E.-W. Were the Hawaiian islands visited by the Spaniards before their discovery by Captain Cook in 1778? *Kungl. Svenska vetenskapsakademiens handlingar*, Band 57, 4. 223 p., 6 pl., 27 fig. Stockholm 1916. 1818

After a long and searching analysis of the whole case, DAHLGREN concludes : « No historical fact proves, nor is there any sort of probability, that the Hawaiian islands were ever visited, or ever seen, by the Spaniards before their discovery by Captain Cook in 1778 ». The whole credit of this discovery which inaugurated the investigation of the N. part of the Pacific Ocean, must then be given to Cook. G. S.

Daniëls, C.-É. Beiträge zur Geschichte der Geburtshilfe. I, II *Janus*, t. 20, 41-46, 489-504, Leyde 1915. 1818

A propos of GEORGE FRIEDRICH MOHR'S « Die gebährende Frau, sammt ihrer Leibes-Frucht in Lebens-Grösse... » Frankfurt 1750, to a certain extent an anticipation of SEMMELWEIS' work of 1861. The whole credit of deals, apropos of the same man, with obstetrical phantoms. G. S.

Delaunay, Paul. La médecine et les idéologues. L.-J. MOREAU DE LA SARTHE. *Bull. soc. franç. hist. méd.*, t. 14, 24-70, 1920. 1818

LOUIS-JACQUES MOREAU, dit MOREAU DE LA SARTHE (Montfort le Rotrou, 1771—Paris 1826), physician, contributor to the *Encyclopédie méthodique*, editor and biographer of VICQ D'AZYR, commentator of LAVATER, SCHWILGUÉ; he was, with CABANIS, the last of the physicians-philosophers. List of his writings, p. 61-70. G. S.

De Toni, Giovanni Battista. Notizie intorno a GIOVANNI BATTISTA VENTURI ricavate da lettere conservate nella Biblioteca Estense di Modena (Frammenti Vinciani, IX). *Archivio di storia della scienza*, vol. II, 240-247. Roma 1921. 1818

Two letters (one dated 1808) from G.-B. VENTURI (1746-1822) who will be best remembered as one of the first to study LEONARDO DA VINCI as a man of science in his « Essai sur les ouvrages physico-mathématiques de LÉONARD DE VINCI. Paris, an V (1797) ». G. S.

Erdmann, Benno. BERKELEYS Philosophie im Lichte seines wissenschaftlichen Tagebuchs. *Abhdl. d. preuss. Akad. d. Wiss., philos.-histor. Kl.*, J. 1919, 122 p. Berlin 1919. 1818

[**Euler, Leonhard**]. Sur l'état actuel de la publication des œuvres d'EULER. Note d'H. FEHR dans l'*Enseignement mathématique*, 21^e année, p. 343-344, Genève 1921. 1818

Les œuvres complètes d'EULER comprendront près de 70 volumes (*Isis* I, 244; II, 165); 10 volumes en avaient paru avant la guerre; 5 autres volumes ont paru depuis. Pour mener cette immense publication à bonne fin, la Société EULER a besoin de l'appui de nouveaux souscripteurs. Le président de la Société et de la Commission EULER est FRITZ SARASIN de Bâle. G. S.

Lacroix, A. Une note de DOLOMIEU sur les basaltes de Lisbonne, adressée en 1779 à l'Académie royale des sciences. *Comptes rendus de l'acad. des sciences*, t. 167, p. 437-444. Paris 1918. 1818

Lane, John E. DANIEL TURNER and the first degree of doctor of medicine conferred in the English colonies of North America by Yale college in 1723. *Annals of medical history*, II, 367-380, New York 1919. 1918

Leersum, E.-C. van. Boerhaaviana. *Janus*, t. 21, 445-456, 1916. 1918

I. B. et la poésie; II. Trois lettres de B.

G. S.

Lint, J.-G. De. The plates of JENTY. *Janus*, t. 21, 129-135, 4 pl. Leyde 1916. 1918

Apropos of the six remarkable obstetrical drawings issued in 1758 by CHARLES-NICOLAS JENTY of London: *Uteri praegnantis et at partem maturi demonstrationes*. Four are reproduced. G. S.

Loewenfeld, Kurt. Contributions to the History of Science (Period of PRIESTLEY, LAVOISIER, DALTON) based on autograph monuments. *Manchester Memoirs*, vol. 57, 1913, 50 p., 17 pl. 1918

Important original documents, some reproduced in facsimile, concerning the scientists named in the title. G. S.

Mascart, Jean. La vie et les travaux du chevalier JEAN-CHARLES DE BORDA (1733-1799). Episodes de la vie scientifique au XVIII^e siècle. Introduction par EMILE PICARD. (*Annales de l'Université de Lyon*, II, 33). 821 p. Lyon, A. Rey, 1919. 1918

La première biographie complète du grand marin et savant BORDA, né à Dax, Landes, en 1733. Cette œuvre est très minutieuse mais prolixe, et il faut tout à fait désapprouver la méthode de l'auteur consistant à donner en notes des notices assez longues des personnages cités. Une biographie n'est pas un dictionnaire biographique, que diable! On comprendrait que l'auteur nous donnât des biographies de personnes relativement peu connues et contemporaines de son héros; il serait assez naturel, en effet, de nous donner des portraits de ceux qui gravitèrent autour de lui. Mais il est tout à fait absurde d'introduire d'autres biographies: qui donc songera à consulter ce livre pour se documenter sur Hipparque, Galilée ou Newton? G. S.

Peachey, G.-C. WILLIAM BROMFIELD, 1713-1792. *Janus*, t. 21, 27-50, 2 portraits, Leyde 1916. 1918

Completes the incorrect notice included in the Dictionary of National Biography. BROMFIELD was a royal surgeon and the author of surgical works, of which PEACHEY gives the bibliography. G. S.

Rolleston, J.-D. The medical interest of CASANOVA's « Mémoires ». *Janus*, t. 22, 115-130, 205-222. Leyden 1917. 1918

Salza, Livia. Un philosophe voyageur du XVIII^e siècle. FRANÇOIS-CONSTANTIN VOLNEY. 45 p. Novara, Stab. tipogr. Cattaneo, 1920. 1918

A sketch of VOLNEY's life and work apropos of the centenary of his death. Born in Craon, Mayenne, 1757, VOLNEY travelled extensively in the Near East and later in the United States and published in 1786 his *Voyage en Egypte et en Syrie*, in 1788 his *Considerations sur la guerre des Turcs*, in 1791 *Les Ruines ou méditations sur les révolutions des empires*, in 1803 the *Tableau du climat et du sol des Etats-Unis*. His was a generous and honest if singular nature. G. S.

- Smith, Edgar-C.** The centenary [of the death] of NAPOLEON. *Nature*, vol. 107, 302-303, 1921. 1818

A brief review of NAPOLEON'S most constructive work, — his encouragement of scientific education and discovery. The author recalls that NAPOLEON himself once said : " The true conquests, the only conquests which cost no regrets, are those achieved over ignorance ". G. S.

- Smith, Edgar-F.** PRIESTLEY in America, 1794-1804. 173 p. Philadelphia, Blakiston 1920. 1818

An elaborate and interesting account of the last ten years of P. 's life spent in exile in America, after the destruction of his house, library and apparatus by an infuriated mob in Birmingham, 1791. P. arrived in New York on June 4, 1794 and was splendidly received and honoured by the people, the authorities, the learned societies. He finally built himself a house in Northumberland, Pa. (about which see *Isis* III, 342). During his American years P. discovered carbon monoxide, yet he devoted more time to religious than to scientific studies and was blinded by his obstinate devotion to the phlogiston. He was a friend of President THOMAS JEFFERSON, and a few of his letters to him are reproduced, including his " Hints concerning public education ". G. S.

- Villaret, Maurice et Moutier, François.** Un essai d'anatomie « dynamique » au XVIII^e siècle. Les *Tabulae sceleti et musculorum* d'ALBINUS. *Bull. soc. hist. méd.*, t. 15, 205-212. Paris 1921. 1818

BERNARD SIEGFRIED WEISS, dit ALBINUS (Francfort 1697-Leyde 1770) : *Tabulae sceleti et musculorum corporis humani*. Leyde, VERBEEK, 1747. Atlas in-plano de 47 p. et 40 pl. gravées, fruit de longues recherches anatomiques poursuivies de 1725 à 1747. ALBINUS édita avec BOERHAAVE la dernière éd. des *Opera* de VÉSALE 1725 ; il prépara la publication posthume de l'anatomie de BART. EUSTACHI et les défauts de ces travaux antérieurs déterminèrent sa propre activité. Son but fut de publier une anatomie aussi vivante, aussi exacte et aussi didactique que possible. Ses études myographiques sont extrêmement consciencieuses ; il fut le premier à montrer les insertions de chaque muscle. Son collaborateur artistique fut WANDELAAR (Amsterdam 1690—Leyde 1759), élève de GÉRARD DE LAIRESSE. Je possède un exemplaire de cet admirable atlas. G. S.

S. XIX

A. — Mathematics.

- Amodeo, Federico.** Le conseguenze della sfida di FLAUTI : NICOLA TRUDI. *Memoria letta all'accademia pontaniana*, 13 Febr. 1921, 21 p. Napoli. 1818

NICOLA TRUDI (1811-1884), was professor of analysis in Naples. It was FLAUTI'S challenge which initiated his mathematical activity (infinitesimal geometry). G. S.

- Riemann, B.** Über die Hypothesen, welche der Geometrie zu Grunde liegen. *Neuhrg. u. erläutert von H. WEYL*. vi + 48 p. Berlin, SPRINGER, 1919. 1818

B. — *Physical sciences and Technology.*

Boltzmann, Ludwig. Vorlesungen über die Prinzipie der Mechanik. Dritter Teil. Elastizitätstheorie und Hydrodynamik. Herausgegeben von HUGO BUCHHOLZ. Leipzig, BARTH, 1920. 1818

Vol. I and II appeared in 1897, 1904.

G. S.

Cajori, Florian. Swiss geodesy and the United States coast survey. *Scientific Monthly*. August 1921, p. 117-129. 1818

The United States coast survey owes its foundation, in 1807, to the untiring efforts and enthusiasm of a Swiss geodesist, FERDINAND RUDOLF HASSLER of Aarau (1770-1843) who came to the U. S. with his family in 1805. The story of HASSLER's life in America, and of his struggles, is very invigorating. HASSLER improved the geodesic instruments; in the making of maps he used what is now called the American polyconic projection. He presented plans for a national observatory in 1816 to the U. S. government. G. S.

Holleman, A.-F. Fünfzigjähriges Benzolstudium. *Janus*, t. 20, 459-488. Leyde 1915. 1818

Karpinski, Louis C. HERMANN VON HELMHOLTZ. *The Scientific Monthly*, July 1921, p. 23-31. 1818

A stimulating sketch of HELMHOLTZ' work apropos of the centenary of his birth (read at a meeting of the Research Club, University of Michigan). G. S.

Lange, Ernst F. BESSEMER, GÖRANSSON and MUSHET. A contribution to technical history. *Manchester Memoirs*, vol. 57, 1913. 44 p., 6 pl. and 1 facsimile letter. 1818

Explaining the parts played by GÖRAN FREDRIK GÖRANSSON (1819-1900) and ROBERT FORESTER MUSHET (1811-1891) in the successful development of Sir HENRY BESSEMER'S (1813-1898) process of steel-making. G. S.

Lumière, A. et L. Résumé des travaux scientifiques, 1837-1914. 308 p. Lyon. Union photographique industrielle, 1914. 1818

Neumann, Franz. Beiträge zur Krystallonomie aus den Jahren 1823 und 1826. Ein Versuch, den wesentlichen Inhalt dieser vor fast hundert Jahren erschienenen fundamentalen Schriften in übersichtlicher und lückenloser Weise darzustellen von C. NEUMANN. *Abhdl. d. math. phys. Kl. d. k. sächs. Gesell. d. Wiss.*, t. 33, 458 p., 22 pl., 66 fig. Leipzig 1916. 1818

I. Methode, den Zusammenhang der Glieder eines Krystallsystems und ihre gegenseitigen Beziehungen graphisch darzustellen, 1823; II. Ueber den eigentümlichen Entwicklungsgang der zwei- und eingliedrigen Krystallsysteme, 1823; III. De lege zonarum, principio evolutionis systematum crystallinorum, 1826. G. S.

Oersted, Hans Christian (1777-1851). Correspondance avec divers savants publiée par M.-C. HARDING. 2 vol. Copenhague, H. ASCHENHOU, 1920. 1818

Oersted, Hans Christian. Scientific life and works, edited by KRISTINE MEYER. CLXVI p. Copenhagen, Hoest & Son, 1920. 1818

This is a part of the first vol. of OERSTED'S Scientific Papers edited by the Royal Danish Society of Sciences. G. S.

Tandberg, J.-G. Ett nyfunnet brev fran H.-C. ÖRSTED. Sætertryk af *Fysisk Tidsskrift*, XIX, 4. Hefte. 3 p. [S. a., 1921?] 1813

Tieghem, Ph. van. Notice sur la vie et les travaux de JEAN-BAPTISTE DUMAS (1800-1884), 38 p., portrait. *Mémoires de l'Académie des sciences*, t. 52, Paris 1914. 1813

C. — Natural sciences

Herwerden, M.-A. van. Eine Freundschaft von drei Physiologen. *Janus*, t. 20, 174-201, 409-436. Leyde 1915. 1813

Deals with three Dutch physiologists : F.-C. DONDERS (1818-1889), J. MOLESCHOTT (1822-1893), I. VAN DEEN (1805-1869). G. S.

Lacroix, Alfred. Notice historique sur BORY DE SAINT-VINCENT (GENÈVE-JEAN-BAPTISTE MARCELLIN). *Mémoires de l'Académie des sciences*, t. 54, 1916, 75 p. avec portrait. 1813

Very elaborate biography with text of documents, bibliographies, etc. — BORY DE SAINT-VINCENT (Agen 1778 — Paris 1846), a traveller and naturalist of great reputation in the first half of the nineteenth century, is now almost entirely forgotten. Yet he deserves to be remembered, were it only because he was the organiser of two great scientific expeditions in Morea and Algeria. G. S.

Marey, Etienne-Jules (1830-1904). Inauguration du monument élevé à sa mémoire, au Parc des Princes à Boulogne-sur-Seine, le mercredi 3 juin 1914. *Mémoires de l'Académie des sciences*, t. 53, 19 p. Paris 1915. 1813

Discours de CHAUVEAU, CHARLES RICHET, RAYMOND POINCARÉ. G. S.

Tieghem, Ph. van. Notice sur la vie et les travaux de CLAUDE BERNARD (1813-1878). *Mémoires de l'Académie des sciences*, t. 52, 42 p., portrait. Paris 1914. 1813

Wollaston, A.-F.-R. Life of ALFRED NEWTON (1808-1907). Preface by Sir ARCHIBALD GEIKIE. xv + 332 p. London, MURRAY, 1921. 1813

D. — Medical sciences

Boerner, Paul. Erinnerungen eines Revolutionärs. Skizzen aus dem Jahre 1848. Herausgegeben von Dr. E. MENKE-GLÜCKERT. 2 Bde. 536 + 319 p. Leipzig, HABERLAND, 1920. 1813

PAUL BOERNER was born in 1829 in Jakobshagen, Pomerania; he died in 1885. He was the founder in 1875 of the *Deutsche medizinische Wochenschrift*. G. S.

Herwerden, A. van. Die Freundschaft zwischen [F. C.] DONDERS [1818-1889] und [ALBRECHT] VON GRAEFE [1828-1870]. *Janus*, t. 23, 81-94. Leyde 1918. 1813

Lutaud, A. Les médecins dans BALZAC, DESPLEIN, DUPUYTREN. *Bull. soc. franç. hist. méd.*, t. 14, 373-381, Paris 1920. 1813

DESPLEIN, personnage de BALZAC, n'est autre que le grand chirurgien DUPUYTREN. G. S.

Lutaud, A. Le romancier BALZAC et le chirurgien DUPUYTREN. *Janus*, t. 21, 379-405. Leyde 1916. 1818

Le personnage du chirurgien DESPLEIN si souvent introduit par BALZAC dans ses romans lui a été inspiré par la grande personnalité de DUPUYTREN (Limousin 1778-1835). G. S.

Pleadwell, Frank Lester. WILLIAM PAUL CRILLON BARTON, surgeon United States navy, a pioneer in American naval medicine (1786-1856). *Annals of medical history*, II, 267-301, New York 1919. 1818

Rosenbloom, Jacob. An appreciation of HENRY BENICE JONES, M. D., F. R. S. (1814-1873). *Annals of medical history*, t. II, 262-264, New York 1919. 1818

The English physician JONES was one of the first modern ones « to value chemistry as an aid in the explanation and cure of disease ». He was a great friend of FARADAY, whose life he wrote (2 vol.); also the friend and physician of DARWIN and HUXLEY, etc. He was the first to describe the occurrence of xanthine in urine. G. S.

E. — *Alia*

Goulard, Roger. Essai médical sur PAUL-LOUIS COURIER [1773-1825]. *Bull. soc. franç. hist. méd.*, t. 15, 139-169. Paris 1921. 1818

Lucas, Frederic A. Glimpses of early museums. *Natural history*, t. 21, 74-77, New York 1921. 1818

Apropos of the BULLOCK's museums which flourished in London from 1795 to 1824, from Major W.-H. MULLENS' account in the *Museum's Journal*, vol. 17, with two illustrations. G. S.

Nass, Lucien. Le siège de Paris et la Commune (Essai de psychologie historique). II + 360 p. Paris, Plon, 1914. 1818

« L'auteur se borne à la clinique historique. Il argumente, non pas en historien — ce qu'il se défend d'être, — mais en médecin, les phénomènes morbides provoqués dans l'organisme social par des événements exceptionnels, tels que le siège d'une ville de deux millions d'âmes et l'insurrection qui suit la capitulation. Il cherche à établir l'étiologie de cette maladie, il la suit dans ses symptômes et son évolution jusqu'au dénouement de la crise et à la guérison... » G. S.

Parodi, Dominique. La philosophie contemporaine en France. Essai de classification des doctrines, vi + 502 p. Paris, ALCAN 1919. 1818

Vecchio-Veneziani, Augusta Del La vita e l'opera di ANGELO CAMILLO DE MEIS. XXIV + 333 p. Bologna, ZANICHELLI, 1921. 1818

Biographie sympathique du grand philosophe et historien de la médecine ANGELO CAMILLO DE MEIS, né à Buccianico, près de Chieti en 1817, mort en 1891. C'était un philosophe hégélien, grand ami de FRANCESCO DE SANCTIS et de BERTRANDO SPAVENTA. Après une carrière agitée et de longues années d'exil il devint professeur d'histoire de la médecine à Bologne et son influence y fut considérable : il n'a pas été remplacé. DE MEIS était un savant, un philosophe, un grand patriote, un homme de bien — il faudrait dire, un saint, et sa vie et sa mort sont également édifiantes. Les questions

qui l'ont le plus occupé sont la lutte contre le positivisme et le darwinisme et surtout les rapports entre la philosophie et la médecine. Cette dernière l'a occupé toute sa vie. DE MEIS était plutôt un philosophe qu'un historien. La biographie du Dott. DEL VECCHIO est très complète. Elle contient une bibliographie et un beau portrait. G. S.

S. XX

Schwarte, M. (Generalleutnant z. D.) (*editor*). Die Technik im Weltkriege. Unter Mitwirkung von 45 technischen und militärischen sachwissenschaftlichen Mitarbeitern. Mit vielen Skizzen und Abbild. x + 610 p. Berlin, MITTLER, 1920. 1818

An elaborate account, sober, authoritative, well illustrated, divided into 3 main parts : A) War on land; B) Naval war; C) Home industries. Each chapter is contributed by a specialist. The book is thus a survey of technological knowledge c. 1918. G. S.

Yerkes, Robert M. (*editor*). The new world of science. Its development during the war. xx + 443 p., illustrated. New-York, Century, 1920. 1818

A study by various specialists of the rôle played by the different sciences in war. It will be particularly interesting for the historian of the year 2500 A. D., studying the strange perversity of the scientists of the beginning of the xxth cent. It is divided as follows : Generalities (at the beginning and the end, by G.-E. HALE and J.-R. ANGELL); Physical science (by R.-A. MILLIKAN, AUG. TROWBRIDGE, H.-E. IVES, H.-E. HOWE); Chemistry (by A.-A. NOYES, CH.-E. MUNROE, CL.-J. WEST); Earth Sciences (by D.-W. JOHNSON); Engineering (by A.-E. KENNELLY, HENRY-M. HOWE); Biology and medicine (by VERNON KELLOGG, FR.-F. RUSSELL, J.-W. HANNER, V.-C. VAUGHAN); Psychology (by R.-M. YERKES). G. S.

PART II

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Historical classification.

1 and 2. — ANTIQUITY

Dieulafoy, Marcel. Quarante. *Comptes rendus de l'Académie des inscriptions*, 1919, p. 13-23. 1818

On the importance attached in antiquity to the number 40. G. S.

Jeanselme, Edouard. Quels étaient les principes d'hygiène et les remèdes en usage parmi les populations agricoles de l'antiquité d'après les Géoponiques. *Bull. soc. d'hist. de la méd.*, t. 15, 7-16, Paris 1921. 1818

Moulé, Léon. Les fraudes pharmaceutiques dans l'antiquité. *Bull. soc. franç. hist. méd.*, t. 14, 199-226. Paris 1920. 1818

- N gl, Alfred.** Die Rechentafel der Alten. *Wien, Akad. d. Wissensch., philos.-histor. Kl., Sitzungsberichte*, t. 177, 86 p. Wien 1914.

1818

An important study on the use of the abacus in Greek and Roman times.
G. S.

- Neuburger, Albert.** Die Technik des Altertums. Zweite, verbesserte Aufl. mit 676 Abb. xviii + 570 S. Leipzig, VOIGTLAENDER 1921.

1818

The first ed. appeared in 1919 (I did not see it); the second ed. apparently is essentially the same but with many improvements in the details. The subject is divided as follows : Der Bergbau. Die Metalle und ihre Gewinnung. Die Bearbeitung der Metalle. Die Bearb. des Holzes. Die Herstellung und Verarbeitung des Leders. Der Ackerbau. Die Gärungstechnik. Die Technik der Oele, Fette, Seifen und Wohlgerüche. Kältetechnik und Konservierung. Die Keramik. Das Glas. Gespinnte und Gewebe. Die Farbstoffe. Die Maltechnik. Technische Mechanik und Maschinen. Feuerzeuge, Beleuchtung und Heizung. Städtebau. Befestigungen. Städtische Strassen und Plätze. Die Häuser. Monumental- und öffentliche Bauten. Bauarten, Bauausführungen und Baustoffen. Die Baumaterialien. Die Wasserversorgung. Die Kanalisation. Bewässerung und Entwässerung. Strassen und Brücken. Schiffe und Schiffbau. Schifffahrt. Die Häfen. — Each chapter is followed by a short bibliography and there are abundant illustrations.
G. S.

- Neveu, Raymond.** La lutte antipaludique chez les Etrusques. *Bull. soc. franç. hist. méd.*, t. 14, 102-107. Paris 1920.

1818

- Sethe, Kurt.** Der Ursprung des Alphabets. *Nachrichten von der kgl. Ges. d. Wiss. zu Göttingen, Geschichtliche Mitt.*, 1916, 88-161.

1818

In favor of the Egyptian origin.

G. S.

- Soutzo, Michel.** Notice sur les origines et les rapports de quelques poids assyro-chaldéens. *Comptes Rendus de l'Académie des inscriptions*, Paris 1919, 150-157.

1818

4. — BABYLONIA and ASSYRIA

- Langdon, S.** The Babylonian conception of the Logos. *Journal of the R. Asiatic Society*. London 1918, p. 433-449.

1818

The Babylonians regarded water as the uncreated first principle and the word chosen to represent it was originally voice, loud cry... THALES may have borrowed his own philosophy from Babylonia. We do not know whether he identified water with *logos*, but HERACLITUS posited fire as his first principle and identified it with *logos*, or reason.
G. S.

- Scheil, Le. P.** La chronologie rectifiée du règne de HAMMOURABI [vers 2100 av. J.-C.] *Mémoires de l'Académie des inscriptions*, t. 39, p. 111-122. Paris 1914.

1818

- Scheil, V.** Recueil de lois assyriennes. Texte assyrien en transcription avec traduction française et index. 125 p. autographiées. Paris, GEUTHNER, 1921.

1818

This Assyrian code dating of the xivth or xiiith cent. b. c. was found on three tablets excavated by the Germans in Assur; a facsimile reproduction

of them was published by E. SCHRÖDER in his *Keilschrifttexte aus Assur*, 1920. The discovery of this code may be said to be the greatest event, for the historian of ancient law, since the publication of HAMMURABI's code in 1902. SCHEIL's book contains the first decipherment of this code, together with a French translation and index. For any one recalling HAMMURABI's code (of c. 2100 B. C.), this new Assyrian one is very depressing; for it illustrates the terrible moral and social decadence which had taken place in the meanwhile. See MORR. JASTROW. An Assyrian law code in *Journal of the American Oriental Society*, vol. 41, 1-59, 1921. G. S.

5. — BIBLE

(*Old Testament Civilization.*)

Macdonald, D.-B. The pre-Abrahamic stories of Genesis as a part of the Wisdom literature. *Studia semitica et orientalia*, Glasgow, 1920, p. 115-125. 1818

The author claims these chapters for the so-called Wisdom literature (*i. e.*, ECCLESIASTES, ENOCH, II ESDRAS, PAUL), makes a very clear statement of the essential nature of that literature, then analyzes the eleven first chapters of Genesis. This is important for the study of the dawn of science. G. S.

Wood, Percival. MOSES. The founder of preventive medicine xi+116 p. London, Society for promoting Christian knowledge, 1920. 1818

6. — BYZANTIUM.

Ebersolt, Jean. Constantinople Byzantine et les voyageurs du Levant. Paris, LEROUX, 1918. 1818

Jeanselme, E. La goutte à Byzance. *Bull. soc. franç. hist. méd.*, t. 14, 137-165. Paris 1920. 1818

7. — CHINA

Andersson, J.-G. The national geological survey of China. *Natural history*, t. 21, 4-12, New York 1921. 1818

An illustrated account of this most hopeful undertaking, a child of the Chinese revolution. It originated at Nanking 1911, Dr. H.-T. CHANG being the first chief. Upon the removal of the central government to Peking, CHANG became director of a school for the training of surveying geologists, while Dr. V.-K. KING was appointed director of the national geological survey. Prof. J.-G. ANDERSSON, late director of the geological survey of Sweden, is curator of the museum of the geological survey of China. Our every good wish to them! G. S.

Andrews, F.-H. Ancient Chinese figured silks excavated by Sir AUREL STEIN at ruined sites of Central Asia. 20 p. London, QUARITCH, 1920. 1818

Cordier, Henri. Histoire générale de la Chine et de ses relations avec les pays étrangers depuis les temps les plus anciens jusqu'à

la chute de la dynastie mandchoue. 4 vol., Paris, PAUL GEUTHNER, 1920-1921. 1818

T. I, 574 p., jusqu'à la chute des Tang, 907; T. II, 434 p., jusqu'à la chute des Mongols, 1368; T. III, 428 p., jusqu'à la mort de KIA K'ING, 1820; T. IV, 427 p. G. S.

Davis, Andrew McFarland. Certain old Chinese notes. *Proc. Americ. Acad. of Arts*, t. 50, 243-286; illust. Boston 1915. 1811

Paper money was used in China as early as the ixth cent., and possibly as the seventh. DAVIS discusses the question, describes specimens, explains China's early economic experiments with paper money and compares them with similar events which took place in Massachusetts in the first half of the xviii cent.

Davis, Andrew McFarland. Ancient Chinese paper money as described in a Chinese work on numismatics. *Proc. Amer. Ac. of Arts*, t. 53, 465-647, Boston 1918. 1818

Completing the preceding note with a translation by KOJIRO TOMITA of the *Ch'üan Pu Tung Chih*, 1833, describing and illustrating many Chinese notes ranging from c. 650 to 1425. G. S.

Giles, Herbert A. Supplementary catalogue of the Wade collection of Chinese and Manchu books in the library of the University of Cambridge. Cambridge, University Press, 1915. 1818

List of the books obtained since 1898, when the Catalogue was published; more than 1300 volumes. The most precious item is the collection of the poetical and prose works of Tu Fu (712-770), with many commentaries, printed in 1204 in 24 vol. G. S.

Groot, J.-J.-M. De. Der Thüpa, das heiligste Heiligtum des Buddhismus in China. Ein Beitrag zur Kenntnis der esoterischen Lehre des Mahāyāna. *Abhdl. d. preuss. Akad. d. Wiss., philos.-histor. Kl.*, J. 1919, 96 p., 6 pl. Berlin 1919. 1818

Herrmann, Albert. Die ältesten chinesischen Karten von Zentral- und Westasien. *HIRTHS Festschrift*, Berlin 1920, p. 185-198, (4 maps). 1818

A preliminary note about the author's researches in Chinese and Central Asian cartography; a more elaborate memoir to appear in SVEN HEDIN. Southern Tibet. Discoveries in former times, vol. VIII, Stockholm 1920. 1. Karten aus der Zeit der Han-Dynastie; 2. Das Wei-Si-yü-t'u; 3. Das Sui-Si-yü-t'u. G. S.

Hirth, Friedrich. Festschrift zu seinem 75. Geburtstag. 16. April 1920. 402 S., Bildn., 54 Abb., 1 Karte. Berlin, OESTERHELD 1920.

Contains a bibliography of HIRTH's writings (1869 to 1917, 106 items). The papers of this Festschrift of interest to us are mentioned in the present bibliography. G. S.

Hülle, H. Die Erschliessung der chinesischen Bücherschätze der deutschen Bibliotheken. *HIRTHS Festschrift*, Berlin 1920, p. 199-219. 1818

[I-Li]. The I-Li or book of etiquette and ceremonial. Translated from the Chinese with introduction, notes and plans by JOHN STEELE.

2 vol. illustr., xxiv + 288 p., viii + 242 p. London, PROBSTHAIN, 1917. 1313

The first complete translation of the *I-Li*.

G. S.

Reismüller, Georg. Zur Geschichte der chinesischen Büchersammlung der Bayerischen Staatsbibliothek. HIRTHS Festschrift, Berlin 1920, 331-336. 1318

[**Rockefeller Foundation**, China medical commission] Medicine in China. viii + 113 p. New York 1914 (second impression 1915). 1313

1. Health conditions in China; 2. Chinese native medicine and surgery (very brief note with reference to G.-A. STUART. Chinese materia medica, Shanghai 1911); 3. Western medicine in China; 4. Standards of medical education under missionary auspices. Teaching in Chinese or in English (conclusion: the teaching in English will take a longer time than the other, but in the long run will secure the largest and best results); 5. Dissection and autopsies; 6. Attitude of the Chinese toward modern medicine; 7. Recommendations (a magnificent program of work, which will be an eternal credit to the ROCKEFELLER foundation and to America). Appendixes. There were, in 1914, 446 Western doctors (men and women) in China, plus 140 foreign nurses. G. S.

Saussure, Léopold de. The calendar of the Muh T'ien Tsz Chuen. *The new China review*, vol. II, 513-516, Shanghai 1920. 1318

This text, written on flat pieces of wood, was discovered in the third century in the tomb of a prince, which had been opened by thieves. The greater part of it deals with a long sporting trip which lasted two years, during which King MUH paid a visit to Si-wang-mu (949 to 946 B. C., or 988 to 985 B. C. G. S.

Schindler, Bruno. Das Priestertum im alten China. 1. Teil: Königtum und Priestertum im alten China. Einleitung und Quellen. (*Diss.*) Leipzig, SPAMER 1918 (?). 1313

8. — EGYPT

Bates, Oric. Ancient Egyptian fishing. *Harvard African studies*, vol. I. 199-271, 26 pl. Cambridge, Mass. 1917. 1313

A very elaborate study based mainly on archæological material, much of which is reproduced in the plates. BATES has dealt also with the chase of the hippopotamus, for these animals were hunted in boats and with harpoons often indistinguishable from those employed in the capture of large fish. The implements studied by the author carry us back very nearly to the beginning of the predynastic period. Contents: Sources; economic importance; religious aspects; papyrus canoe; harpoon; bident (two-pronged fish spear); hook and line; weel (wicker fish trap); hand net; cast net; double hand net; seine; fish curing; fisherman; conclusion. G. S.

Gennep, A. van et Jéquier, G. Le tissage aux cartons et son utilisation dans l'Égypte ancienne. 130 p. in-f°, 5 planches en couleurs, 135 illustr., 1 planche de rubans tissés en coton-soie, reproduisant des motifs égyptiens. Neuchâtel. DELACHAUX et NIESTLÉ, 1916. [125 exemplaires]. 1313

Cette étude est d'un grand intérêt pour l'historien de la technologie,

mais aussi pour l'historien de l'art car la plupart des motifs décoratifs employés par les anciens Egyptiens furent empruntés à l'art du tisserand (certains à l'art du vannier). Le plus ancien métier à tisser connu date du Moyen Empire (environ 2200), c'est un métier horizontal: un autre métier — vertical celui-là — date du Nouvel Empire (1500-1000). Il est probable que de pareils métiers étaient déjà employés dès l'Ancien Empire. Les étoffes considérées dans le présent travail sont plutôt des rubans ou des galons, et des métiers spéciaux ont dû être utilisés pour les faire. Pour résoudre ce problème, les auteurs ont fait une étude comparative du tissage aux cartons chez les Egéens, les Syriens et dans l'Egypte copte. G. S.

Hamburger, Ove. Zwei Darstellungen von Krankheiten aus dem alten Aegypten. *Janus*, t. 19, p. 241-245, 2 pl. Leyde 1914. 1818

Apropos of a stele of the 18th Dyn. of the Ny Carlsberg Glyptoth. representing a man with an emaciated leg, and of the statue of King MENTHOTEP in a tomb nr. Thebes with legs and feet of enormous size.

G. S.

Hooton, E.-A. Oral surgery in Egypt during the Old Empire. *Harvard African studies*, vol. 1, Cambridge 1917, p. 29-32, 2 pl. 1818

The specimen examined by the author establishes beyond a reasonable doubt the existence of a rudimental knowledge of oral surgery in the Old Empire. This specimen was discovered by Dr. K.-H. THOMA; it is a mandible belonging to a fragmentary skeleton from an Old Empire tomb excavated by G.-A. REISNER at Giza and now in the PEABODY Museum, no. 59303.

G. S.

Sterns, F.-H. The paleoliths of the Eastern Desert. *Harvard African studies*, vol. I, 48-82, 1 map, 18 pl. Cambridge, Mass. 1917. 1818

Discussion of the flint implements discovered by G.-W. MURRAY in 1914 in the Eastern Desert of Egypt, now in the PEABODY Museum. G. S.

9. — GREECE

Bell, Edward. Hellenic architecture. Its genesis and growth xx + 185 p. London, BELL, 1920. 1818

Bianchi, Lorenzo. Der Kalender des sogenannten CLODIUS TUSCUS (Griechische Kalender hrg. von FRANZ BOLL, 4). *Sitzungsberichte d. Heidelberger Akad. d. Wiss., philos. hist. Kl.*, t. 5, 1914, 56 p. 1818

Is the Greek text of this calendar a translation by LYDUS of a Latin original, or did LYDUS follow a Greek original? BIANCHI claims that the second hypothesis is the true one. According to him the original source of all ancient calendars is the EUDOXI et METONIS antiquorumque fasti astrologorum. From this source derived: 1. Greek popular tradition; 2. *Vetus calendarium rusticum Romanum*. From 2 derived: VARRO, COLUMELLA, OVIDIUS, POLEMIIUS SILVIUS. WACHSMUTH on the other hand does not recognize the popular tradition, and for him the so-called CLODIUS calendar derives from 2, in the same way as VARRO's, etc. G. S.

Capelle, Wilhelm. Berge und Wolkenhöhen bei griechischen Physi- kern. (*Stoicheia*, 5), 47 p. Leipzig, TEUBNER, 1916. 1818

Günther, Sigmund. Die antike Apokatastasis auf ihre astronomischen und geographischen Grundlagen geprüft. *Bayer. Akad. d. Wiss., Sitzungsber. d. math. phys. Kl.*, München 1916, 83-112.

1918

The Greek notion of ἀποκατάστασις (*restitutio in integrum*) was relative both to astronomical and to geographical (*ex. gr.* periodical floods) periods, but they never tried to establish an internal relation between the celestial and terrestrial phenomena. GÜNTHER studies the development of this notion in Greek and also in later times. 1. Begriffsbestimmung; 2. A. in ihrer Abhängigkeit vom Sterrenhimmel; 3. Wesen und Erklärungsversuche der Ueberflutungen; 4. Wechselwirkung zwischen Himmel und Erde.

G. S.

Luce, Stephen Bleeker. A brief history of the study of Greek vase-painting. *Proc. of the Amer. philos. soc.*, t. 57, 649-668. Philadelphia 1918.

1918

One finds the first references to painted vases in the *Museum Romanum* of LA CHAUSSE 1690 and at about the same time in GRAEVIUS' *Thesaurus*; some are published in MONTFAUCON'S *L'antiquité expliquée*, Paris 1719. The oldest album of Greek vases is GIOV. BAT. PASSERI. *Picturae Etruscorum in vasculis*, 3 vol., 1767-1775. The first accurate album is perhaps TISCHBEIN'S *Vases d'Hamilton*, 1791-1803... First scientific catalogue OTTO JAHN, Pinakothek of Munich, 1854 .. A list of museums containing Greek vases follows.

G. S.

Moïssides (de Constantinople). La puériculture et l'eugénique dans l'antiquité grecque. III. Après la naissance. *Janus*, t. 19, 289-311. Leyde 1914.

1918

Neveu, Raymond. Le culte d'ESCUAPE et d'HYGIE dans les îles de la mer Egée. *Bull. soc. hist. méd.*, t. 15, 189-198. Paris 1921.

1918

Nilsson, Martin P. Die Entstehung und religiöse Bedeutung des griechischen Kalenders. *Acta Universitatis Lundensis*, XIV : 2, 65 p. Lund 1918.

1918

Rehm, Albert. Griechische Windrosen. *Sitzungsber. d. Bayer. Ak. d. Wiss., philos.-phil. Kl.*, München 1916, 104 p.

1918

1. HOMER and the prescientific period; 2. The Ionian physicists; 3. ARISTOTLE; 4. TIMOSTHENES; 5. The Hellenistic system of 8 winds; 6. POSEIDONIOS. — The fragment ἀνέμων θέσεις.

G. S.

Rolleston, J.-D. The medical aspects of the Greek anthology. *Janus*, t. 19, p. 35-45, 105-131. Leyde 1914.

1918

Roscher, Wilhelm Heinrich. Neue Omphalosstudien. *Abhdl. d. Gesell. d. Wiss., philol. hist. Kl.*, t. 31, 7 pl., 90 p. Leipzig 1915.

1918

1. Ueber die Etymologie von ὀμφαλός und die Bedeutung des Nabels bei den Griechen und andern Völkern; 2. Der Gedanke eines Zentrums (Nabels) der Erdoberfläche bei verschiedenen Völkern; 3. Branchidai (Didyma) und sein Orakel als Nabel der Erde; 4. Delphi und sein Orakel als Mittelpunkt der Welt und sein Nabelstein; 5. Weitere wahrscheinlich nicht von Delphi abhängige Kulte des APOLLON, ASKLEPIOS usw., in denen Omphaloi vorkamen; 6. Grabmonumente in Omphalosform; 7. Problematische Omphaloi.

G. S.

- Withington, E.-T.** The Asclepiadae and the priests of ASCLEPIUS. *Studies in the history and method of science*, vol. II, 192-205. Oxford 1921. 1515

The author gives some additional reasons for rejecting the superficial view that Hippocratic medicine "originated in the health temples". G. S.

- Zeuthen, H.-G.** Sur l'origine historique de la connaissance des quantités irrationnelles. *Bull. de l'Académie royale de Danemark*. Copenhagen 1915, p. 333-362. 1515

A comprehensive account and discussion of this moot subject, with bibliography. G. S.

10. — INDIA

- Binyon, Laurence.** The court painters of the Grand Moguls. With historical introduction and notes by T.-W. ARNOLD. 86 p., 40 pl. (many in colour). Oxford University Press 1921 [s. 63]. 1515

A splendid collection of reproductions of these Mogul paintings, chiefly portraits, of the xvth and xvith cent. Though far less charming and less impressive than the Rajput paintings, these paintings are very beautiful. To call them Indo-Persian is misleading; they are really Hindu, though with traces of Persian influence in the earliest of them and of European influence in the latest. It is interesting to note that the earliest evidence of the importation of these paintings in Europe is found in drawings made by REMBRANDT c. 1640-1650. A very suggestive account by L. BINYON is preceded by an historical outline by ARNOLD. The latter has also contributed notes to the paintings reproduced, chiefly biographical. The lack of an index is regrettable. G. S.

- Bloomfield, Maurice.** On the art of entering another's body : a Hindu fiction motif. *Proc. of Amer. philos. soc.*, t. 56, 1-43. Philadelphia 1917. 1515

- Faddegon, B.** The Vaiçesika-system described with the help of the oldest texts. *Verhand. d. K. Akad. van Wetenschappen, Afd. Letterkunde*, t. 18, 614 p. Amsterdam 1918. 1515

Elaborate study of this system of philosophy, to which much less attention has been devoted than to the Vedānta and the Sāṃkhya-Yoga, although it is certainly not less important for the understanding of Indian science. Book II contains an exposition of the system divided as follows : 1. Metaphysics; 2. Physics; 3. Mathematical notions (number, time, space, movement); 4. Psychology; 5. Sources of knowledge; 6. Ethics and theology. Comparisons are made with the other Indian and European systems. Important. G. S.

- Fleming, Daniel Johnson.** Schools with a message in India. 210 p. illustr. Oxford University Press 1921 1515

- Hume, Robert Ernest.** The thirteen principal Upanishads, translated from the Sanscrit with an outline of the philosophy of the Upanishads and an annotated bibliography. 556 p. Oxford University Press 1921. 1515

Ojha, Rai Bahadur Pandit, **Gaurishankar Hirachand**. The Palæography of India. Second ed. revised and enlarged. Ajmer. Scottish Mission Industries Co., 1918. 1818

See review by J. Ph. V. in *Journal R. Asiatic Soc.*, 1919, 617-619.

Oldenberg, Hermann. BUDDHA. Sein Leben, seine Lehre, seine Gemeinde. 6. Auflage. Berlin 1914. 1818

First ed., 1881; 2nd. 1890; a seventh revised ed. has appeared recently (c. 1920). G. S.

Stevenson, Mrs. (Margaret) Sinclair. The rites of the twice-born. (*The religious quest of India*). xxiv + 474 p. Oxford University Press, 1920. 1818

Vidyabhusana, M.-M. Satis Chandra. Influence of ARISTOTLE on the development of the syllogism in Indian logic. *Journal R. Asiatic Society*, London 1918, 469-488. 1818

The works of ARISTOTLE were very well known in India during the first six centuries of our era. G. S.

11. — IRAN

Diez, Ernst. Churasanische Baudenkmäler. 1. Bd. (*Arbeiten des kunsthistorischen Instituts des Universitäts Wien*, 7) xii + 116 p., 41 pl. Berlin, REIMER, 1918. 1818

12. — ISLAM

Goldziher, Ignaz. Stellung der alten islamischen Orthodoxie zu den antiken Wissenschaften. *Abhdl. d. preuss. Akad. der Wissensch.*, J. 1915, *Philos.-hist. Kl.*, Nr. 8, 46 p. Berlin 1916. 1818

Explains the increasing distrust felt by the orthodox Moslems of the Eastern Caliphate against the 'ulūm al-awā'il or 'ulūm al-qadīmā (the sciences of the ancients), that is, chiefly Greek science, or else positive (vs. theological) sciences. The harassing of AL-KINDI under MUTAWAKKIL is likely the earliest example of the growing intolerance. G. S.

Hess, J.-J. Der arabische Ausdruck für Zuckerrohr in el-Jemen. *Sitzungsber. d. physik. mediz. Gesell.*, t. 48, 87-88, Erlangen 1918. 1818

Jaussen et Savignac (RR. PP.) Mission archéologique en Arabie, II. El-'Ela, d'Hégra à Teima, Harrah de Tebouk. 3 parties gr. in-8°. Paris, GEUTHNER 1914 [1920]. 1818

T. I, xv + 690 p. Itinéraire et archéologie; T. II, 153 planches et cartes; T. III, 97 p. Les coutumes des Fuqara. G. S.

Kremer, Alfred von. The Orient under the Caliphs. Translated by S. KHUDA BUKHSH. xiv + 463 p. University of Calcutta 1920. 1818

This is supposed to be a complete translation of Baron VON KREMER's classical work "Culturgeschichte des Orients unter den Chalifen", 2 vol.

xii + 548 p., 517 p. Wien 1875-1877. At least, as the author does not say a word to the contrary, the reader will likely believe that the translation is complete. In fact we are simply given a transl. of chapters 1 to 6, 8 and 9 (out of 19 chapters). Chapter 7 devoted to Finances has been omitted without any warning! It seemed unnecessary to carry the comparison further. As far as scholars are concerned this translation is non-existent. Such half-baked work is not to the credit of the University of Calcutta. G. S.

Meyerhof, M. Die Optik der Araber Ein Sammelbericht. *Zeitschrift für ophthalmologische Optik*, J. VIII, 16-29, 42-54, 86-90. Berlin 1919 [reprint dated 1920]. 1919

A very important memoir giving in brief compass a comprehensive survey of Islamic optics. The Moslems who contributed to the progress of optics belonged to one of the five following categories: 1. Translators; 2. Natural philosophers; 3. Mathematicians; 4. Oculists; 5. Encyclopædists. MEYERHOF considers successively these five categories, devoting a special paragraph to each important personality. G. S.

Stevenson, William Barron. Some specimens of Moslem charms. *Studia semitica et orientalia*, Glasgow, 1920, p. 84-114. 1918

1. The seven sleepers; 2. Charm of Murjanë (Morgana); 3. A Damascus charm roll; 4. Solomon and the evil eye; 5. Magic squares in Arabic charms; 6. The seven seals (one of these mysterious signs, called "the seal of the five corners", is the Pythagorean pentagram). G. S.

Wiedemann, Eilhard. Ueber von den Arabern benutzte Drogen. (Beiträge zur Gesch. der Naturw., 49). *Sitzungsber. d. physik. medicin. Societät*, t. 48-49, p. 16-60. Erlangen 1918. 1918

This essay written with the collaboration of ADOLF GROHMANN, Vienna, is essentially a translation of the chapters relative to drugs in the great encyclopædia published by AL NUWAIRI (d. 1332) of Tripolis, with commentary, including biographic and geographic notes. A chapter deals with the examination and falsification of drugs according to ABŪ MUṢĀ' AL 'ATTAR, who fl. c. 1260 in Cairo. See also under S. XIV, p. 407. G. S.

Wiedemann, Eilhard. Ueber die Kriechtiere nach AL QAZWINI nebst einigen Bemerkungen ueber die zoologischen Kenntnisse der Araber (Beitr. zur Gesch. d. Naturw., 53). *Sitzungsber. d. physik. medicin. Ges.*, t. 48, 228-285, Erlangen 1918. 1918

I. Einleitung — Ueber Mineralogie und Botanik. Allgemeines über Zoologie. Quellen für die arabische Zoologie: AL GAHIZ (d. 869); AL DAMIRI [1344-1405]; AL QAZWINI [1203-1283]; AL NUWAIRI (d. 1332); AL ABSCHINI (d. 1440); die getreuen (lauteren) Brüder (c. 950-1000); AL AGDABI (d. 1203); Schriften über Tierheilkunde. Von den Arabern behandelte Tierarten. Sammlungen lebender Tiere.

II. AL QAZWINI über die Kriechtiere und Insekten... (Üebersetzung und Bemerkungen).

III. Stellen aus AL QAZWINI über Wassertiere und AL DINAWARI [d. 895] über Insekten.

IV. Beziehungen zwischen Tier und Mensch. G. S.

Wiedemann, Eilhard. Ueber den Zucker bei den Muslimen. (Beitr. zur Gesch. d. Naturw., 52). *Sitzungsber. d. medicin. Gesell.*, t. 48, 177-185, Erlangen 1918. 1918

1. Orte, an denen Zucker vorkommt; 2. Frühe Erwähnung des Zuckers;

3. Zuckerpressen; 4. Zucker in Rechenaufgaben; 5. Qatr und Qatr 'Asal; 6. Sukkar, Tabar zad u. s. w. als Dattelarten; 7. Ueber Zucker u. s. w. ausscheidende Pflanzen — Nachträge (Beitr., 55) *ibidem*, 322-328.

G. S.

Wiedemann, Eilhard. Ueber Parfüms und Droge bei den Arabern. (Beitr. zur Gesch. d. Naturw., 56). *Sitzungsber. d. physik. mediz. Ges.*, t. 48, 329-344. Erlangen 1918. 1813

1. Zahl der Parfüms; 2. Einzelne Parfüms; 3. Verzeichnis der Parfüms bei ABÜ'L QASIM und WASCHSCHA; 4. Allgemeines über Parfüms. Bemerkungen von Prof. HESS in Zürich und J.-W.-C. GOETHART. G. S.

Wiedemann, Eilhard. Zur Geschichte des Kompasses bei den Arabern. *Verhdl. der deutschen physik. Gesellschaft*, 1919, 665-667. 1813

This is the third paper by WIEDEMANN on this subject (see *ibidem*, t. 9, 764, 1907 and t. 11, 202, 1909). There are but few Arabic descriptions of the compass. WIEDEMANN reproduces the often quoted description published in 1282 by BAILAK AL QABAGAQI, referring to the use of the compass at sea in 1242; he gives a new description not very different from the first, extracted from a Berlin MS. dated 1702. G. S.

Wiedemann, Eilhard. Ueber die angebliche Verwendung des Pendels zur Zeitmessung bei den Arabern. *Verhdl. d. Deutschen physik. Gesell.*, 1919, p. 663-664. 1813

Discussing the often repeated statement that the Arabs used the pendulum for time measurement already c. 1000. The source of this statement is ED. BERNARD, *Phil. Trans.*, London, t. 14, 567, 1684. WIEDEMANN has found nothing in his long studies to substantiate it. G. S.

Wiedemann, Eilhard. Bestimmung der Durchmesser der um und in regelmässige Vielecke beschriebenen Kreise und des Inhaltes von Flächen und Körpern sowie Stücke einer Lehre al Gabr wa'l Muqābala. (Beiträge zur Gesch. d. Naturwiss., 58). *Sitzungsber. d. physik. med. Sozietät*, Bd. 50-51. Erlangen 1918-1919, p. 264-271; Gefäss zum Regeln des Wasserausflusses bei Wasseruhren. (Beitr..., 59). *Ibidem*, p. 272-274. 1813

Two more extracts from the Paris MS., SLANE, no. 2468, translated and annotated. — The contrivance described in the second one is more perfect than that of the Pseudo ARCHIMEDES and similar to GAZARI'S. The names of the months are Syriac. G. S.

Wiedemann, Eilhard. Eine Sonnenfinsternis, ein Erdbeben, ein Meteor und ein Meteorstein nach arabischen Quellen. *Das Weltall*, J. 20, 154-155, 1920. 1818

The three first observations are related by IBN AL ATHÏR (1160-1234) in his Universal History. He himself observed the sun eclipse on Ramadan 29, 571 (April 11, 1176) in his native place Gazira ibn Omar upon the Tigris. The fall of a meteoric stone is reported by IBN BATTÛTA (1303-1377). G. S.

Wiedemann, Eilhard. Einleitungen zu arabischen astronomischen Werken. *Das Weltall*, 20. J., 21-26, 131-134; 1919-1920. 1818

The Introductions to the Moh. scientific works are of great philosophic interest. WIEDEMANN gives us here annotated translations of the following introductions: AL FARGHĀNĪ's introd. to a book on the astrolabe (first half of the ixth cent.); introd. of AL BIRŪNĪ to a memoir on all the possible

methods of constructing the astrolabe (first half of the xith cent.); introd. of another work on the astrolabe by the same; introd. to the astro. nomic tables (al zig al gâmi) by ABUL HASAN KUSCHJÂR B. LABBÂN B-BÂSCHAHRI AL GILI (= from Gilan) who fl. c. 971-1029 (see SUTER no. 192 and WIEDEMANN, Beitr., no. 43); introd. to a writing on the Indian circle (i. e. a gnomon in the center of a circle) by HUSAIN B. AL HUSAINI AL CHALCHÂLI († 1014 or 1030). G. S.

Wiedemann, E. (unter Mitwirkung von E. SEIDEL und O. RESCHER). Zur Geschichte des Bades und des Badens bei den Orientalen. *Z. f. physikalische und diätetische Therapie*, Bd. 24, 239-248, Leipzig 1920. 1918

Wiedemann, Eilhard. Definitionen verschiedener Wissenschaften und über diese verfasste Werke. (Beitr. zur Gesch. d. Naturw., 57). *Sitzungsber. d. physik. medicin. Gesell.*, t. 50, 1-32, Erlangen 1920. 1918

1. Im *Fihrist* von AL NÂDÎM (d. 995) aufgeführte Werke; 2. Definitionen nach IBN SÎNÂ; 3. Definitionen nach AKFÂNÎ (d. 1348, also called ANSÂRÎ or SACHÂWÎ); 4. Definitionen nach HÂGGÎ CHALFA (c. 1600-1658); 5. Aus der Schrift über die Wissenschaften von AL TAUBÎDÎ (fl. c. 1000). G. S.

13. — ISRAEL

Wolfson, Harry Austryn. The needs of Jewish scholarship in America. *The Menorah Journal for February* 1921, 8 p. 1918

A spirited plea for Jewish scholarship, especially the study of mediæval Jewish philosophy. "Mediæval philosophy is one philosophy, written in three languages, Arabic, Hebrew and Latin, and among these, Hebrew holds the central and most important position. In it we have the full efflorescence of Arabic thought and the bud of much of scholasticism". Yet, a great deal of this Jewish literature is still unpublished. WOLFSON suggests that American Jewry should present the Republic of Letters with a *Corpus Scriptorum Philosophicorum Hebraeorum*. We would sign this plea with both hands. G. S.

14. — JAPAN

Griffis, William Elliot. The Mikado : institution and person. A study of the internal political forces of Japan. vii + 346 p. Princeton University Press, 1915. 1918

The author spent a good part of his life in Japan as professor at the Imperial university of Tokyo. He is a fervent admirer of the late emperor MUITSUHO. G. S.

Hara, Katsuro. An introduction to the history of Japan. xx + 411 p. New York and London, PUTNAM 1920. 1918

The first publication of the Yamato society, a Japanese organization, the object of which is to explain Japan to the Western peoples. A popular account; apparently well-informed; a little prolix. G. S.

Waley, Arthur. Japanese poetry. The « Uta », 110 p. Oxford University Press 1919. 1918

15. — MIDDLE AGES

- Beazley, C. Raymond.** A note-book of mediæval history. A. D. 323-
A. D. 1453. VIII + 224 p. Oxford, Clarendon Press, 1917. 1S18

A notebook in which the fundamental divisions are chronological, and containing fairly copious references to the history of civilization.

- Crane, T.-F.** Mediæval sermon-books and stories and their study since 1843. *Proc. Amer. philosoph. soc.*, t. 56, 369-402, Philadelphia 1917. 1S18

- Dreyer, J.-L.-E.** Mediæval astronomy. *Studies in the history and method of science*, vol. II, 102-120. Oxford 1921. 1S18

An extensive review of the mediæval part of PIERRE DUHEM. *Le système du monde*, t. I-V, 1913-1917. This review has almost the value of an original study and should be read by anyone studying DUHEM's book.

G. S.

- Gleichen-Russwurm, A. von.** Der Ritterspiel. Geschichte der vornehmen Welt im romanischen Mittelalter. 5. Tausend. xvi + 436 p. Stuttgart, HOFFMANN, 1918. 1S18

- Gleichen-Russwurm, A. von.** Die Gotische Welt. Sitten und Gebräuche im späten Mittelalter. 4. Tausend. xvi + 429 p. Stuttgart, HOFFMANN, 1919. 1S18

" Die Gotische Welt " is the fifth and last but one volume of the author's " Geschichte der Geselligkeit Europas ". It is divided as follows : I. Bürgertum und Absolutismus ; II. An den Quellen des Humanismus ; III. Im grossen Totentanz ; IV. Die letzten Ritter. — A subjective synthesis based upon considerable literary knowledge. G. S.

- Jeanselme, E.** Le vin, la vigne et l'alcoolisme dans les Gaules à l'époque de l'établissement des barbares (v^e-x^e s.). *Bull. soc. franç. hist. méd.*, t. 14, 264-300. Paris 1920. 1S18

- Menetrier, P.** L'alcoolisme cause de la dégénérescence de la race chez les rois mérovingiens. *Bull. soc. franç. hist. médéc.*, t. 14, 301-309. Paris 1920. 1S18

- Norlind, Arnold.** Einige Bemerkungen über das Klima der historischen Zeit, nebst einem Verzeichnis mittelalterlicher Witterungserscheinungen. *Acta Universitatis Lundensis, nova series*, X, 55 p. Lund 1914. 1S18

A very important study of climatic variations during the Middle Ages followed by a chronological summary of the main meteorological phenomena from 709 to 1499; with indication of sources. Follow two more special studies of the same kind : the freezing of the Baltic and the Kattegat ; SIGEBERTI *Chronographiae Continuatio Aquicinctina* (A. D. 1149-1201). G. S.

- Poole, Reginald Lane.** Medieval reckonings of time (Helps for students of history, 3), 47 p. London, Society for promoting Christian knowledge, 1918. 1S18

- Prutz, Hans.** Die Friedensidee im Mittelalter. *Sitzungsber. d. Bayer. Akad. d. Wiss., phil. Kl.*, München 1915. 42 p. 1S18

Reinhardt, Hellmuth. Auszug aus der Abhandlung : Ein Tractat über Arzneiwässer, nach ihren Wirkungen zusammengestellt, aus dem Breslauer *Codex Salernitanus* zum ersten Male hrg. und mit dem Texte eines Codex [no. 1502] aus der Biblioteca angelica zu Rom verglichen. (*Diss.*, Leipzig) 22 p. Freiberg i. Sa. 1921. 1915

Contains the Latin text *de aquis medicinalibus et earum differentiis*, Breslau *codex Salernitanus*, f° 177r to 179r. No mention of alcohol, which became widely known in S. Italy c. 1160 1170. G. S.

Streeter, Edward Clark. Cultural factors influencing science in the Pre-Renaissance. *Bull. of the medical and chirurgical faculty of Maryland*, vol. 13, 2-8, Baltimore 1920. 1918

Streeter, Edward Clark. Mediaeval libraries of medicine 500 A. D. to 1500 A. D. *Bulletin of the medical library association*, t. 10, 15-20, January 1921. 1919

A delightful account starting with CASSIODORUS' list (c. 535); interesting for the history of medical education. G. S.

Wickersheimer. Figures médico-astrologiques des ix^e, x^e et xi^e siècles. *Janus*, t. 19, p. 155-177, 11 fig., Leyde 1914. 1918

1. Macrocosme et microcosme; 2. Les signes du zodiaque et le corps humain; 3. La sphère de PETOSIRIS; 4. La sphère d'APULÉE ou de PYTHAGORE; 5. Le Tétragone sujet; 6. Les trois figures du ms. lat. 17868 de la Bibl. Nation. — Toutes ces figures relèvent presque exclusivement de la tradition païenne. G. S.

16. — ROME

Guelliot, O. Les oculistes gallo-romains de Reims. *Bull. soc. hist. méd.*, t. 15, 182-188. Paris 1921. 1915

Mygind, Holger. Die Wasserversorgung Pompejis. *Janus*, t. 22, 294-351, 27 fig. Leyde 1917. 1918

Strong, Mrs. Arthur. Apotheosis and after life. Three lectures on certain phases of art and religion in the Roman empire. xx+293 p., 32 pl. New York, DUTTON, 1915. 1918

Apotheosis of the imperial figure and its influence on design; Symbolism of the after life on the gravestones of the later Roman empire; After life. — With an introductory address on Rome and the present state of Roman studies. G. S.

PART III

Systematic Classification.

1. — ANATOMY

Cole, F.-J. The history of anatomical injections. *Studies in the history and method of science*, vol. II, 285-343, illustr. Oxford 1921. 1918

An elaborate study of this subject down to our days, but chiefly of the developments which took place in the xvth and xvith cent. HARVEY'S

work (1628) was the fundamental influence in the early injection experiments. "The period of injection lies between 1650 and 1750, after which interest in injections gradually declined as it was found that the new method was unable to realize the great expectations of its professors. FREDERIK RUYSCH's activities are comprised between the dates 1665 and 1728 and hence coincide almost exactly with the middle of the injection period. The first injections, however, were not anatomical, but were undertaken for physiological or medical reasons... In 1667, and again in 1670, the French Academy conducted numerous injection experiments in the belief that the reinvigoration and even the rejuvenescence of mankind would be thereby accomplished...".

G. S.

3. ARCHÆOLOGY

Museums and Collections.

Bates, Oric [editor]. *Harvard African studies I. Varia Africana I.* VIII + 292 p., 4°, illustr. The African Department of the PEABODY Museum of Harvard University. Cambridge, Mass., 1917.

1818

The scope of this new publication may be defined as African anthropology in the widest sense. A preface to this first volume was contributed by THEODORE ROOSEVELT.

G. S.

Deonna, W. *L'archéologie. Ses principes, son utilité. Leçon d'ouverture du cours d'archéologie classique et orientale à l'Université de Genève*, 17 janvier 1921, 16 p. Genève, SONOR, 1921.

1818

Definition and aims of archaeological research briefly stated by a scholar whose ideas have already been fully analyzed in *Isis*, I, 745-754, III, 481.

G. S.

4. — ART. ART and SCIENCE

Iconography.

Lavignac, Albert (editor). *Encyclopédie de la musique. Première partie. Histoire de la musique. 2^e fascicule. Italie, Allemagne*, p. 611-1175. Paris, DELAGRANGE 1914.

1818

Italie (p. 611-910) : XIV^e et XV^e siècles par GUIDO GASPERINI; XVI^e et XVII^e siècles par OSCAR CHILESOTTI; l'opéra au XVII^e siècle en Italie par ROMAIN ROLLAND; XVIII^e et XIX^e siècles par I. VILLANIS; 1725 à 1792 par M. SOFFREDINI; 1792 à 1837 par G. RADICIOTTI et A. CAMETTI (ROSSINI et son école); Période moderne par ALBERT SOUBIES; Les contemporains par GIOVANNI MAZZONI.

Allemagne : Les origines de l'opéra (XVII^e siècle) par ROMAIN ROLLAND; La musique religieuse depuis les Psaumes de SCHÜTZ 1619 jusqu'à la mort de BACH 1750 par ANDRÉ PIRRO; Les grands classiques (XVIII^e siècle) par MICHEL BRENET; Le romantisme, 1815 à 1837 par P.-H. RAYMOND-DUVAL; Période contemporaine par CAMILLE LE SENNE (presque exclusivement consacré à WAGNER).

Le texte contient de nombreux exemples musicaux.

G. S.

Means, Philip Ainsworth. A survey of ancient Peruvian art. *Transactions of the Conn. academy of arts and sciences*, vol. 21, 315-442, 17 pl. New Haven 1917. 1818

The main purpose of the author is to establish a basis for the classification of pre-Columbian Peruvian art objects; therefore his study is confined "to those regions where the form and stratigraphic relations of the various art-types that make up the sequence of cultures have been determined with a reasonable degree of precision". See p. 393 a "table to show roughly the chronological order of the early Peruvian culture periods". The cultures follow one another in this order: 1. Proto-Chimu, Proto-Nasca, Tiahuanaco I; 2. Tiahuanaco II; 3. "Epigonal" and Red-white-black; 4. Chimu and Nasca, Colla-Chulpa, Early Inca; 5. Inca Empire. G. S.

Schlosser, Julius von. Materialien zur Quellenkunde der Kunstgeschichte. Heft 1-3. *Wien, Akademie d. Wiss., Philos.-hist. Klasse, Sitzungsber.*, t. 177, 179, 180, 1914-1916. 1818

I. Heft. *Mittelalter* (t. 177, 1914, 102 p.): Ueber Begriff und Umfang der Kunsthistorischen Quellenkunde; 1. Beginn. der abendländischen Kunstlit.; 2. Die mittelalterl. Kunstlit.; 3. Zur Kunsttheorie des Mittelalters; 4. Theorie und Praxis im toskanischen Trecento.

II. Heft. *Frührenaissance* (t. 179, 1915, 72 p.): 1. Die historische Lit.; 2. Die Theoretiker; 3. Die historischen Thesen; 4. Die kunsthistor. Thesen.

III. Heft. 1. *Hälfte des Cinquecento* (t. 180, 1916, 76 p.): 1. LEONARDO'S Vermächtnis; 2. Kunsthistoriographie; 3. Kunsttopographie; Beginn der Guiden lit. (This critical bibliography is also of interest for the history of arts, of perspective, of technology). G. S.

6. — ASTRONOMY, GEODESY, METEOROLOGY and TERRESTRIAL PHYSICS

Arrhenius, Svante. Le Destin des Étoiles. Études d'astronomie physique. Traduction française par T. SEYRIG (*Nouvelle collection scientifique*) v + 218 p., 31 fig. Paris, ALCAN, 1921. [fr. 8]. 1818

Cet ouvrage, dont la première édition suédoise parut en 1915 ou 1916, fait suite aux deux livres d'ARRHENIUS intitulés: *l'Évolution des Mondes et la Vie de l'Univers*. On y retrouve les mêmes larges vues synthétiques appuyées sur une connaissance précise et profonde de tous les faits pertinents. Les sujets suivants sont étudiés: L'énigme de la voie lactée: Influence de la vapeur d'eau sur les climats (critique des théories d'HUNTINGTON); Atmosphère et constitution des corps stellaires; Planète Mars; Mercure, la Lune et Vénus; Origines du culte des étoiles (conférence, Bologne 1911). S. ARRHENIUS a mis à jour certaines parties de la traduction française. Les illustrations sont les mêmes que celles de l'édition anglaise, sauf que l'une d'elles qui n'était point exacte, a été remplacée.

G. S.

Bigourdan, G. [Various notes on French astronomy]. *Comptes rendus de l'Académie des Sciences*, t. 166-167, Paris 1918. 1818

I do not quote these notes individually for they are merely of local interest and will be reprinted in book form. G. S.

Collard, Auguste. L'astronomie et les astronomes. (Répertoire des ouvrages à consulter. Collection créée pour l'avancement des sciences, des lettres et des arts en Belgique). viii + 120 p. Bruxelles, VAN OEST, 1921. 1818

Une liste de 758 titres complétant l'admirable bibliographie de HOUZEAU et LANCASTER. La plupart des ouvrages mentionnés ont donc paru depuis 1880. Les titres sont classés comme suit : dictionnaires et encyclopédies d'astronomie ; biographies d'astronomes (celle de SIMON NEWCOMB n'est pas citée) ; traités d'astronomie (généraux et spéciaux) ; histoires ; bibliographies ; atlas ; revues ; tables. Cette liste sera utile quoique ce ne soit pas du tout une bibliographie synthétique (*Isis* III, 159) et que les notes critiques soient très rares et insuffisantes. G. S.

Dannemann, Friedrich Wie unser Weltbild entstand. Die Entwicklung der Vorstellungen über den Bau des Kosmos von den Anfängen bis zur EINSTEIN'SCHEN Relativitätstheorie. 18. Aufl. 80 p. Stuttgart, Kosmos, 1921. 1818

A popular and well illustrated account of the development of astronomy by the well-known author of "Die Naturwissenschaften in ihrer Entwicklung". G. S.

Ginzel, F.-K. Beiträge zur Kenntnis der historischen Sonnenfinsternisse und zur Frage ihrer Verwendbarkeit. *Abhdl. d. kgl. preuss. Akad. d. Wiss.*, J. 1918, *Physik. mathemat. Kl.*, Nr. 4, 43 p., 2 pl. Berlin 1918. 1818

Series of studies devoted to the following solar eclipses (total or annular) : 693 (1030), 1033, 1113 (1131), 1133, 1147, 1187 (1194), (1236), 1239, 1241, (1263), (1312), 1330 (1337), 1339, 1361. (I have written between brackets those not included in the second list). List of ancient eclipses : —1062, —762, —647, —584, —556, —477, —430, —399, —309, —128, +71, +197, +418. Medieval eclipses (only the utilisable ones quoted) : 483, 590, 693, 733, 840, 878, 891, 939, 968, 1033, 1113, 1133, 1147, 1187, 1191, 1239, 1241, 1267, 1330, 1339, 1361. G. S.

Günther, Siegmund. Die indirekten Ortsbestimmungsmethoden in der Entwicklung der mathematischen Geographie. *Sitzungsber. d. math. physik. Klasse d. Bayer. Akad. d. Wiss.*, 1919, 299-351. 1818

By *indirect* method GÜNTHER means when the reading is not made on a circle but on a straight line, thus necessitating the calculation of the corresponding angle. 1. Dreistab und geometrisches Quadrat; 2. Der Grundgedanke des JAKOBSSSTABES; 3. LEVI BEN GERSCHOM und REGIOMONTANUS; 4. Der JACOBSSTAB im Entdeckungszeitalter; 5. Das 16., 17. und 18. Jahrh. G. S.

Schück, Albert (Brieg, Silesia, 1833-Hamburg, 1918). Der Kompass. 3 Bde., f°. Selbstverlag des Verfassers. Hamburg 1911-1918. Druck von EMIL KORFF, Deichstrasse 49. 1818

Vol. I, 1911 contains 46 plates with explanations (17 p.) retracing graphically the whole evolution of the compass from the early Chinese originals down to c. 1909.

Vol. II, 1915, plates 47 to 79 (Sagen von der Erfindung des Kompasses. Magnet, Calamita, Busssole, Kompass. Die Vorgänger des Kompasses).

Vol. III, 1918, plates 80-88 (Nachtrag zu II. Armierte Magnetsteine (natürliche Magnete) mit verzierter Fassung.

This work of fundamental importance should be completed by an index. The author was a captain in the German navy (see obituary notice by FELDHAUS in *Geschichtsblätter für Technik*, vol. VI, 218). G. S.

Stimson, Dorothy. The gradual acceptance of the Copernican theory of the universe. 147 p., 3 pl. New York, The BAKER and TAYLOR Co., 354 Fourth Avenue, New York 1917. 1918

A study in the history of thought. 1. Historical sketch of the heliocentric theory; 2. Reception of the Copernican theory: opinions and arguments in the xvth cent.; BRUNO and GALILEO; gradual acceptance of the theory; the church and the new astronomy.

Appendices: translation from the *Almagest*; *de revolutionibus* (dedication to the Pope); BODIN and FIENUS. G. S.

7. — BIBLIOGRAPHY and LIBRARIES

Jacobs, Katharine. A list of American doctoral dissertations printed in 1918. 200 p. (Library of Congress). Washington, Government printing office 1921. 1918

A list of the 360 doctoral dissertations published in the U. S. in 1918. The full titles are given in alphabetical order, then again classified by subject. Each title is thus quoted fully twice. This seems a sheer extravagance. A list of 360 titles without criticism of any kind should not fill 200 pages (that is less than 2 titles per page!). A classification of the doctors by universities is interesting. I would suggest the addition of a few statistical summaries. G. S.

8. — BIOLOGY

Hagedoorn, Arend L. and Hagedoorn-Vorstheuveel La Brand, A.-C. The relative value of the processes causing evolution. 294 p., with 20 fig. The Hague, MARTINUS NIJHOFF, 1921. 1919

The authors have been much struck by the fact that each theoretician of evolution, excepting DARWIN, has always over-emphasized one point, one single link in the chain of processes which goes to the making of species, and has brought out his point as « the » cause of evolution. This one-sidedness has been aggravated by the fact that most geneticists were either zoölogists (like WEISMANN) or botanists (like de VRIES). After DARWIN, no one has set forth a comprehensive theory of evolution worth the name. The authors have tried to emulate him, taking into account all the new knowledge available. Their outline is divided as follows: Heredity; Variation; Crossing; Reduction of variability; Mutation; Selection; Species and varieties; Law of JOHANNSEN; Evolution in nature and under domestication; Status of man; Bibliography. The law of JOHANNSEN as formulated by the authors is this: the nature of the genes does not admit of qualitative variation (1915). G. S.

Haldane, John Scott. Mechanism, life and personality. An examination of the mechanistic theory of life and mind. Second edition, vii + 152 p. London, MURRAY, 1921 (first, ed., 1914). 1919

Singer, Charles. Greek biology and its relation to the rise of modern biology. *Studies in the history and method of science*, vol. II, 1-101. Oxford, 1921. 1918

Reviewed in *Isis*, IV, 380 (SARTON).

9. — BOTANY.

Arber, E.-A. Newell [c. 1871-1918]. A sketch of the history of palaeobotany with special reference to the fossil flora of the British coal measures. *Studies in the history of science*, vol. II, 472-89, illustr. Oxford, 1921. 1818

Introduction. The pre-scientific period (Italian renaissance; EDWARD LILLY. *Lithophylacii Britannici ichnographia*, 1699; JOHN WOODWARD. A catalogue of English fossils, 1728-1729; etc.). Transition to the scientific period (E.-F. VON SCHLOTHEIM. *Beschreibung merkwürdiger Kräuter-Abdrücke und Pflanzen-Versteinerungen*, 1804; *Petrefactenkunde*, 1820; WILLIAM MARTIN. *Petrificata Derbiensia*, 1809; JAMES PARKINSON. *Organic remains of a former world*, 1804.

Scientific period : I. Pioneer stage, 1818-1870; II. Early scientific study of petrifications; III. Intermediate period in the study of incrustations; IV. Modern period, from about 1870. — Reproductions of ancient palaeobotanical images illustrate beautifully this important memoir. G. S.

Buller, A.-H. Reginald. Essays on wheat, including the discovery and introduction of marquis wheat, the early history of wheat-growing in western Canada, the origin of red bobs and kitchener and the wild wheat of Palestine. xv + 340 p., 50 illustr. New York, MACMILLAN, 1919. 1818

Leclerc, Henri. Histoire de l'ail. *Janus*, t. 23, 167-191, Leyde, 1918. 1818

Leclerc, Henri. Histoire du lierre. *Bull. soc. hist. méd.*, t. 15, 17-37. Paris, 1921.

10. — CHEMISTRY.

Backer, H.-J. Oude chemische werktuigen en laboratoria van ZOSIMOS tot BOERHAAVE. 68 bdz., 51 abd., Groningen, WOLTERS, 1918 [fl. 1. 90]. 1818

A very interesting and well illustrated study of chemical instruments from the days of Alexandrian alchemy to BOERHAAVE, which originated in a series of lectures organized to celebrate the opening of the new laboratory for organic chemistry at the University of Groningen. The author deals first with the *Instruments*, considering successively digesters; apparatus for distillation and filtration; crucibles; ovens; lute, etc.; then with the *Laboratoria*; the oldest labor; the alchemical labor. of the xvth and xvth cent.; the first scientific labor. in the xvth cent., for ex. LIBAVIUS' plan of 1606. G. S.

Bein, Willy. Das Stein der Weisen und die Kunst Gold zu machen. Irrtum und Erkenntnis in der Wandlung der Elemente, mitgeteilt nach den Quellen der Vergangenheit und Gegenwart. 174 S. mit 10 Abbild. (*Voigtländers Quellenbücher*, 88) Leipzig, VOIGTLÄNDER, 1915. 1818

An anthology of alchemy from the earliest times to our days. G. S.

Chemical Society. Annual reports of the progress of chemistry for 1920. Vol. 17. x + 264 p. London, GURNEY and JACKSON, 1921. 1818

Lippmann, O. von. Noch einmal « Caput mortuum ». *Chemiker-Zeitung*. 1921, n° 100. (reprint, 3 p.). 1818

The red iron oxide was often called *Caput mortuum* and *colcothar*. The origin of the first phrase is Egyptian-Greek; of the second, Greek-Syriac.
G. S.

Moureu, Charles. La chimie et la guerre. Science et avenir (Les leçons de la guerre). III + 384 p. Paris, Masson, 1920. 1818

11. — ECONOMICS.

Broodbank, Sir Joseph-G. History of the Port of London. In two vol. illustr. London, Daniel O'Connor, 1921. 1818

Sir JOSEPH has written this history from the earliest days down to our own but he does not claim any special authority for the period preceding the xviiith cent. On the other hand in writing the later chapters he has had the advantage of access to Port records of the last 120 years, supplemented by 49 years' association with Port administration. Historians and economists will find it profitable to compare the advantages of the various forms of control which have prevailed in the Port during past centuries. These books are richly illustrated with reproductions of old prints (some in colour), portraits, maps, etc.
G. S.

12. — EDUCATION.

Bruxelles. Université internationale L'université internationale. Documents relatifs à sa constitution. Rapport. Conférence. Statut. Session inaugurale. 146 p. Bruxelles, Palais mondial 1920. 1818

Herzog M.-A. Sind den Fachlehrern für Naturwissenschaften altsprachliche Kenntnisse vonnöten? Mit einem sozialistischen Nachwort und einem Anhang: 1. Der Philosoph ARISTOTELES in den Quellschriften zur Geschichte der Erziehungslehre; 2. Aufbau und Ausbau des grossstädtischen Schulwesens (Basels). 120 p., 1 pl. Basel, 1921. 1818

Watson, Foster (editor). An encyclopædia and dictionary of education. Part I. LONDON, PITMAN, 1921. 1818

13. — ETHNOLOGY. PRIMITIVE and POPULAR SCIENCE.

Adriani, N. Schwangerschaft und Geburt bei den Toradja in Mittel-Celebes. *Janus*, t. 23, 108-117. Leyde, 1918. 1818

Günther, Siegmund. Ethnologisch-Mathematisches. *Sitzungsber. d. bayer. Akad. d. Wiss., math. phys. Klasse*, München 1917, 111-125. 1818

General reflexions on ethnological theories (convergence vs. derivation) with special reference to two independent position systems with zero, the decimal system of the Hindoos and the vigesimal system of the Mayas.
G S

Hartland, Edwin Sidney Primitive society. The beginnings of the family and the reckoning of descent. 180 p. London, METHUEN, 1921. 1818

Hough, Walter. Man and metals. *Proceedings of the National Acad. of sciences*, vol. II, 123-9, Washington, 1916. 1818

A summary of Hough's long studies on the subject. The first free metals discovered by man were copper, gold and silver. Later he acquired by heat, tin and iron. G. S.

Kleiweg de Zwaan, J.-P. Kleidung und Krankheiten. Ethnologische und historische Betrachtungen. *Janus*, t. 21, 63-110, Leyde, 1916 1818

Kreemer J. jun. Volksheilkunde im malaischen Archipel. *Janus*, t. 20, 47-71, 113-142, 202-231, 365-408, Leyde, 1915. 1818

Nilsson, Martin P. Primitive time reckoning. (*Acta societatis humaniorum litterarum Lundensis*, I). XIII + 384 p. Lund, GLEERUP, 1920. 1818

An exhaustive study of the subject divided as follows: Day; seasons; year; stars; month; months; old Semitic months; calendar regulation (intercalation, beginning of the year); popular months of the European peoples; solstices and equinoxes, aids to the determination of time; artificial periods of time, feasts; calendar-makers; conclusion. The substance of the book was ready in the spring of 1917. The author was not able to include the additional material gathered by H. WEBSTER in his *Rest Days*, New York, 1916, but this material would not affect his conclusions.

Stevenson, Matilda Coxe. Ethnobotany of the Zuñi Indians. *Thirtieth annual report of the Bureau of American ethnology*, 1908-1909, p. 31-102. Washington, 1915.

Medical practice and medicinal plants. Edible plants. Use of plants in weaving, in dyeing, in basketry, in pottery decoration, for the toilet, in folk-lore. Clan names and other names derived from plants. Ceremonial uses of plants. List of plants. G. S.

14. — GEOGRAPHY.

Endrös, A. Zum Problem des Euripus. *Sitzungsber. d. bayer. Ak. d. Wiss., math. physik. Kl.*, München, 1914, 99-139.

A scientific study of the irregular currents taking place between the isle of Euboea and the Greek mainland; a very old oceanographical problem, For ARISTOTLE'S views on the subject, see *Isis*, IV, 395. G. S.

Norlind, Arnold. Das Problem des gegenseitigen Verhältnisses von Land und Wasser und seine Behandlung im Mittelalter. *Acta Universitatis Lundensis, nova series*, xiv : 1, 57 p. Lund 1918. 1818

The ocean problem in ancient times, in patristic times. Moslem geography. The problem in later mediæval times. For a later development of the same problem (first attempt to measure the ratio of the areas of land and sea by AL. PICCOLOMINI (1557) see *Isis* IV, 141, under ALMAGIÀ. G. S.

Ruge, W. Aelteres kartographisches Material in deutschen Bibliotheken. Fünfter Bericht über die Jahre 1910—1913. *Nachrichten der Kgl. Ges. d. Wiss. zu Göttingen, philol.-histor. Kl.*, 1916 Beiheft 128 p. 1818

The first report appeared *ibidem* in 1904. G. S.

Wensinck, A.-J. The ideas of the Western Semites concerning the navel of the earth. *Verhand. d. k. Ak. van Wetenschappen, Afdeling Letterkunde*, t. 17, xii + 65 p. Amsterdam 1917. 1918

Wensinck, A.-J. The ocean in the literature of the Western Semites. *Verhand. d. k. Ak. van Wetenschappen, Afd. Letterkunde*, t. xix, xii + 66 p. Amsterdam 1918. 1918

The ocean in cosmogony, The ocean in cosmography (under the earth, above the earth). Character of the ocean. G. S.

Young, Geoffrey Winthrop (editor) Mountain craft. xviii + 603 p. ill., London, METHUEN, 1920. 1918

15. — GEOLOGY, MINERALOGY, PALÆONTOLOGY, MINING

(for palæobotany and palæozoology, see respectively botany and zoology).

Gregory, J.-W. National contributions to Geology. (*Scientia*, xxx, 1^{er} juillet 1921, 1-12; traduct. française: Supplément, 1-12). 1918

1) The recognition and use of fossils; 2) systematic paleontologæ; 3) fossils and evolution; 4) geological cartography; 5) the stratigraphical classification; 6) mineralogy; 7) petrology; 8) metamorphic rocks; 9) tectonic and structural geology.

La traduction française est faite sans soin.

L. G.

Haug, Emile Les disciplines de la géologie. *Revue générale des sciences*, t. 101-111, 165-175, 229-238. Paris 1921. 1918

1. G. descriptive; 2. G. dynamique; 3. G. historique; 4. G. régionale; 5. G. appliquée. — Conclusions G. S.

Holmes, Arthur. The nomenclature of petrology, with references to selected literature. 284 p. London, MURBY, 1920.

Pogue, Joseph-E. The Turquois. A study of its history, mineralogy, geology, ethnology, archaeology, mythology, folk lore and technology. 162 p., 22 pl. *Memoirs of the National Acad. of Sciences*, t. 12, part. II. Washington 1915. 1918

A very elaborate review of everything pertaining to Turquois. It includes a study of the *chalchihuitl* question. The *chalchihuitl* used by the ancient Mexicans was turquois or jade? G. S.

Schuchert, Charles. Atlantis and the permanency of the North Atlantic Ocean. *Proc. of the Nat. Ac. of Sci.*, t. 3, 65-72. Washington 1917. 1918

A reply to TERMIER's paper (*Isis* III, 135), concluding "that there are no known geologic data that prove or even help to prove the existence of PLATO'S Atlantis in historic times". G. S.

16. — HISTORY OF CIVILIZATION. GENERAL HISTORY. HISTORICAL METHODS. BIOGRAPHY and CHRONOLOGY.

Cabanès, Auguste. Fous couronnés. 439 p., 56 illustr. Paris. ALBIN MICHEL [1914]. 1918

Biographies médicales de JEANNE LA FOLLE, PHILIPPE II d'Espagne, PIERRE

LE GRAND, PIERRE III, PAUL I de Russie, CHRISTIAN VII de Danemark, OTHON et LOUIS II de Bavière. G. S.

Croce, Benedetto Theory and history of historiography. Translated from the Italian by DOUGLAS AINSLIE. 317 p. London, HARRAP, 1921. [15 s.] 1S1S

This is the fourth and last volume of the *Philosophy of the Spirit*, of which it forms the conclusion. The three first volumes were respectively entitled : Logic; Philosophy of the Practical; Æsthetic. The translation of vol. iv is made from the 2nd Italian ed., 1919. It is divided into two parts: Theory of historiography; Concerning the history of historiography. The second part is of greater interest to us, though I must admit that it is almost as repellent to me as the rest of CROCE's philosophy. It will probably appeal more to people who are more metaphysically minded than I. As to myself, I can hardly read it, for the diffuseness, prolixity, obscurity and confusion of this book irritate me to a degree. It is neither philosophy nor history; neither fiction nor truth. Take it away! G. S.

Stoddard, Lothrop. The rising tide of color against white world-supremacy. With an introduction by MADISON GRANT, XXXII + 320 p. New York, SCRIBNER, 1920. 1S1S

A very clear and forcible summary of universal history from the racial point of view. The author shows the dangers of race mixture and urges that Asia be given back to the Asiatics and the domains inhabited by the white race closed to them. The Great War has been essentially a civil war of the white race. G. S.

19. — MATHEMATICS.

Lecat, Maurice. Bibliographie des Séries Trigonométriques, avec un appendice sur le Calcul des Variations. 169 p. Chez l'auteur, Avenue du Bois de la Cambre, 16, Bruxelles 1921. 1S1S

L'auteur bien connu par ses recherches sur les déterminants à n dimensions, nous offre ici une abondante bibliographie des séries trigonométriques par ordre alphabétique des noms d'auteurs. Il y a en tout 2560 travaux, dont 935 en français, 765 en allemand, 495 en anglais, 110 en latin, 100 en italien, etc. Des 1000 auteurs cités, 268 sont Allemands, 158 Français, 135 Anglais, 65 Italiens, etc. Une classification de ces mémoires par sujets, et une classification chronologique eussent été fort utiles. Une bibliographie du calcul des variations terminant cet ouvrage, complète la bibliographie publiée par l'auteur en 1913-1916. LECAT est l'auteur français du fasc. de l'*Encyclopédie des sciences mathématiques* relatif au Calcul des Variations, 288 p. 1913-1916. Il avait préparé le texte français du fasc. relatif aux Séries trigonométriques (env. 900 p.), mais ce texte ne verra probablement jamais le jour, l'*Encyclopédie* ayant été tuée par la « Conférence interalliée des académies scientifiques », — une belle œuvre de chauvinisme obscurantiste! (voir *Isis* IV, 39). G. S.

Loria, Gino. Les contributions des différents peuples au développement des mathématiques. 1^{re} partie : Événements mémorables et hommes représentatifs dans l'histoire des mathématiques. 2^{me} partie : Le caractère international de la pensée mathématique. [*Scientia*, XXIX, 1^{er} mars et 1^{er} avril 1921, 169-184, 235-262]. 1S1S

La conclusion de ce mémoire est un appel à une concorde joyeuse et vraiment internationale entre les mathématiciens : « ne nous efforçons pas d'élever des barrières où tout conseille de construire des ponts ». L. G.

Smith, David-E. Ten great epochs in the history of mathematics [*Scientia*, XXIX, 1^{er} juin 1921; 417-429; traduct. française; supplément, 79-89.] 1315

Bref aperçu du développement général des mathématiques, partagé en dix périodes qui débordent nécessairement les unes sur les autres, n'ont ni commencement, ni fin définis. 1^o Epoque de l'intuition; 2^o Epoque de la déduction: THALÈS, PYTHAGORE, PLATON; 3^o Epoque de l'exposition: EUCLIDE, APOLLONIUS, DIOPHANTE; 4^o Epoque de l'application: ARCHIMÈDE, ERATOSTHÈNE, HIPPARQUE, HÉRON, PTOLÉMÉE; 5^o Epoque du symbolisme numérique: introduction du système des chiffres actuellement employés; 6^o Epoque de la poésie, du VII^{me} au XII^{me} s. dans l'Inde; 7^o Epoque de la transmission: traductions latines des Grecs d'après les traductions arabes; 8^o Epoque du symbolisme: VIÈTE, DESCARTES, OUGHTRED; 9^o Epoque de la géométrie supérieure, que l'on peut faire commencer à DESARGUES, et qui est naturellement encore ouverte, ainsi que 10^o Epoque de l'analyse supérieure, préparée par les EUDOXE, PYTHAGORE, ARCHIMÈDE, etc., et qui commence vraiment au début du XVII^{me} s. avec FERMAT et DESCARTES.

L. G.

Soreau, Rodolphe. Sur l'origine et les sens du mot « abaque ». *Comptes Rendus de l'Académie des Sciences*, t. 166, p. 67-69. Paris 1918. 1315

L'origine est le mot ἀβάξ qui signifie tablette. Ce mot grec désignait un simple tableau alphabétique des nombres. Comparaison des termes abaque et nomogramme.

G. S.

Tropfke, Johannes. Geschichte der Elementar-Mathematik in systematischer Darstellung mit besonderer Berücksichtigung der Fachwörter. Erster Band. Rechnen. 2^{te} verbesserte und sehr vermehrte Auflage. VIII + 177 p. Berlin, Vereinigung wissenschaftl. Verleger 1921. [M. 131.50] 1315

A. Die Zahlen im allgemeinen; B. Die Masse; C. Die ganzen Zahlen; D. Die Brüche; E. Angewandte Rechnen.

G. S.

Vetter, Quido. La storia della matematica presso i Cechi. *Archivio di storia della scienza*, vol. II, 199-201. Roma 1921. 1315

A short review of Bohemian work on the history of mathematics.

G. S.

20. — MECHANICS

Poor, Charles Lane. The motions of the planets and the relativity theory. *Science*, vol. 54, 30-34, 1921. 1315

Vollgraff, J.-A. CHRISTIAAN HUYGENS (1629-1695) et JEAN LE ROND D'ALEMBERT (1715-1783). *Janus*, t. 20, 269-313. Leyde 1915. 1315

21. — MEDICINE

A. — *History. Organization and Philosophy.*

Cyrlax, Richard J. A short history of mechano-therapeutics in Europe until the time of Ling. *Janus*, t. 19, 178-240. Leyde 1914. 1315

Ancient Greece;—Roman empire until viiith cent.; 700-1600; xviiith cent.; 1700-1750; 1750-1813. The account stops at the year 1813, in which

the Royal Central Gymnastic Institute was founded at Stockholm with P. H. LING at its head. CYRIAX is satisfied that before LING's innovations, medical gymnastics with but few exceptions (*ex. gr.* QUELLMALZ' abdominal frictions, 1735) had made no substantial advance since the time of GALEN, ARETAEUS and PAULUS ÆGINETA. G. S.

Feyfer, F.-M.-G. De. Zur Geschichte des Schamfugenschnittes in Holland (bis 1840). *Janus*, t. 19, 312-327, 341-379. Leyde 1914.

1818

Footte, John. Ancient poems on infant hygiene. *Annals of medical history*, t. II, 213-227. New York 1919.

1818

Fosseyeux, Marcel. Les aliénés à Paris. *Communication faite au premier congrès de l'art de guérir*. 11 p. Anvers 1921.

1818

Ces notes sur l'hospitalisation des aliénés à Paris sous l'ancien régime se rapportent surtout aux XVII^e et XVIII^e siècles. G. S.

Janet, Pierre. Les médicamentations psychologiques. Études historiques, psychologiques et cliniques sur les méthodes de la psychothérapie, 3 vol., 346 + 308 + 494 p. Paris, ALCAN, 1919.

1818

I. L'action morale, l'utilisation de l'automatisme; II. Les économies psychologiques; III. Les acquisitions psychologiques.

Johnsson, J.-W.-S. Landfahrrer in Dänemark. *Janus*, t. 20, 235-268. Leyde 1915.

1818

Includes a list of itinerant foreign doctors and quacks in Denmark, the successors of the Salernitan *circumforanei*, most of them of the XVIIth and XVIIIth cent. Important contribution to the study of medical practice in Denmark. G. S.

Johnsson, J.-W.-S. Folkmedicinske undersøgelser. *Danske Studier*, 1921, 20 p., 1 pl. Copenhagen.

1818

Three investigations on folk medicine: 1. On some jugs made of *Terra sigillata*, though not of the real one, and kept in the Danish National Museum (to appear later in French); 2. On the *healing step* practised by the howling dervishes in Scutari, an old medical superstition which the author traces as far back as the palæolithic fragment called "la femme au renne"; 3. On a singular cure of *incontinentia urinae* (running naked through a church up to the altar, etc). G. S.

Lützhöft, Fr. Ein Abschnitt aus der Geschichte des Kindbettfiebers. *Janus*, t. 22, 357-371. Leyde 1917.

1818

[**Medicine, history. Italy.**] Un istituto storico dell' arte sanitaria italiana. *Archivio di storia della scienza*, vol. II, 291-293, Roma 1921.

1818

Apropos of the recent foundation of this Institute for the History of Medicine in Rome. The Institute will be located in the Hospital Santo Spirito (in the part rebuilt by SIXTUS IV). President, MARIANO BORGATTI; secretary, PIETRO CAPPARONI. A bulletin will be published; a museum organized; lectures delivered, etc. G. S.

Parker, G. The early history of surgery in Great Britain Its organization and development. (*Comrie's Medical History Manuals*). x + 204 p., 8 pl. London, BLACK, 1920.

1818

"Early" in the title means down to 1850! -- This popular account is

divided into 6 parts; 1000 to 1300; 1300 to 1500; 1500 to 1600; 1600 to 1700; 1700 to 1800; 1800 to 1850. The two first parts — down to 1500 — cover only 67 p. ! There is a bibliography at the end, purely English, and a brief chronology ranging from 850 to 1858. G. S.

Pergens, Ed. (—1917). *Optotypes. Janus*, t. 22, 406-413. Leyde 1917.

1818

Trad. franç. de la notice relative à sa collection d'optotypes exposée à Leyde en 1907. PERGENS possédait peut-être la plus riche collection d'optotypes qui ait jamais été rassemblée. Les vrais optotypes ne datent que du XIX^e siècle (1810, FISHER et GERSON; 1816, TAUBER; 1825, PERKINJE, etc.) mais leur préhistoire commence déjà en 1623 avec DACA DE VALDEZ. G. S.

Pino y Roca, J. Gabriel. Breves apuntes para la historia de la medicina y suos progresos en Guayaquil. 75 p. Guayaquil. Imp. y Papeleria Sucre, 1915.

1818

This interesting little volume — the first, to my knowledge, to be devoted to the history of medicine in Ecuador — was published very opportunely at the eve of the first meeting of the "Congreso Médico Ecuatoriano". It retraces the progress of medicine in Guayaquil from the arrival of PIZARRO in 1530 to 1822, that is, during the whole colonial period. I hope that señor don GABRIEL PINO Y ROCA may soon publish the second part of this history, from 1822 to 1915. No index. G. S.

Rambaud, Pierre. L'enseignement de la chirurgie à Poitiers avant le XIX^e siècle. *Janus*, t. 21, 182-195, 2 illustr. Leyde 1916.

1818

Ruhräh, John. A bibliography of pediatrics. *Bull. of the medical library association*, t. 10, p. 21-24. Jan. 1921.

1818

Saintyves, P. L'art de guérir est-il d'origine empirique? *Janus*, t. 22, 372-390. Leyde 1917; t. 23, 56-76, 1918.

1818

Spain, Catalonia Bibliografia medical di Catalunya. Inventari primer. Près dels llibres antics i moderns presentats en l'exposició bibliogràfica anexa al segon congrés de metges de llengua catalana celebrat a Barcelona del 24 al 28 de Juny de 1917. Cederari posat en ordre alfabètic d'autors, entitats i noms geogràfics. 4^o, xxxii + 478 p. 8 pl. Barcelona, 1918.

1818

Contains 2620 items arranged alphabetically by authors. G. S.

Sudhoff, Karl. Medizinische Bibliotheken. Eine historische Plauderei. 8 p. Leipzig, Gustav Fock, 1921.

1818

A spirited sketch taking the reader from the earliest days of Mesopotamia and Egypt to our own. The Library of SUDHOFF's "Institut" contains now about 15,000 volumes. G. S.

Torkomian, Vahram. Les Arméniennes dans l'histoire de la médecine. *Bull. soc. hist. méd.*, t. 15, p. 38-44, Paris 1921.

1818

La première Arménienne citée s'appelait AGHVIDA (AGHAVITHI); elle était d'origine grecque et mariée au prince arménien SOURENE SALAHOUNY; elle a fondé vers 260-270 la première léproserie (à Arbénoud, Arménie). G. S.

Weindler, F. Der Kaiserschnitt nach den ältesten Überlieferungen unter zugrundelegen von 18 Geburtsdarstellungen. *Janus*, t. 20, p. 1-40, 9 pl. Leyde 1915.

1818

- Wood, C. A. and Garrison, F. H.** A physician's anthology of English and American poetry. xxiii + 346 p. Oxford University Press, 1920. 1S1S

B. — *Epidemiology. History and geography of disease.*

- Andel, M. A. van.** Plague regulations in the Netherlands. *Janus*, t. 21, 410-444, 4 ill. Leyde 1916. 1S1S

- Barbécieux, G.** Contribution à l'étude de l'histoire de la lèpre. La lèpre dans la plus haute antiquité. *Janus*, t. 19, p. 132-149. Leyde 1914. 1S1S

- Cleu, Hubert.** Les maladies épidémiques et contagieuses en Lorraine du ix^e au xix^e siècle. *Bull. soc. franç. hist. méd.*, t. 13, 236-249, 1914. 1S1S

- Lint, J. G. de.** Les léproseries d'Amsterdam. *Bull. soc. hist. méd.*, t. 15, 107-114. Paris 1921, 1S1S

- Schwarz, Ignaz.** Bibliotheca Venereologica. Geschichte und Literatur der venerischen Krankheiten. 15., bezw. 16. bis 20. Jahrhundert. 106 S., 2184 Nr. Antiquariat Katalog Nr. 4. Wien, I. Habsburgergasse, 3. [1920?]. 1S1S

- Streeter, Edward C.** Exhibit of medical texts illustrating practice in fevers, plague, etc. 44 p. Boston Public Library 1921. 1S1S

Interesting catalogue of an exhibition organized in June by Dr. STREETER for the annual session of the American medical association — 161 items, mostly from Streeter's own library, some loaned by the Boston medical library. Its purpose was to illustrate the history of the specific infections and epidemic diseases from HIPPOCRATES to SYDENHAM. The catalogue contains much valuable bibliographic information. The order is chronological, with digressions on Plague, Syphilis and Venesection. G. S.

22 — MORALS

- Robertson, John Mackinnon.** A short history of morals. vii + 460 p. London. WATTS, 1920. 1S1S

23. — PHARMACY and PHARMACOLOGY

- Leclerc, Henri.** Les sternutatoires à travers les âges. *Janus*, t. 21, 254-262. Leyde 1916. 1S1S

- Leclerc, Henri.** Histoire des ellébores et de l'elléborisme. *Janus*, t. 22, 223-238. Leyde 1917. 1S1S

- Meyerhof, M.** Histoire du chichm, remède ophtalmique des Égyptiens. *Janus*, t. 19, 261-288. Leyde 1914. 1S1S

Les Égyptiens modernes appellent *chichm* toute espèce de collyre sec blanc en poudre; mais le mot désigne surtout un collyre fait à l'aide des graines de *Cassia absus* L. Ce collyre sec n'a guère de valeur curative. MEYERHOF s'efforce d'établir son origine. G. S.

24. — PHILOSOPHY, HISTORY OF PHILOSOPHY

Brulez, Lucien. Het Vrijheidsbegrip. xvi + 239 bdz. 's Gravenhage, MARTINUS NIJHOFF, 1920. 1818

The substance of lectures delivered by the author, a *Belgian*, at the *German* university of Ghent, during the war, on the notion of freedom! It is divided as follows: Problem of free will. Principle of substantiality and formal determinism, — and real determinism; principle of causality; occasionalism; nature of fate; Kantian notion of freedom; contemporary French philosophy; principle of finality. G. S.

Merz, John Theodore. A fragment of the human mind. xiv + 309 p. Edinburgh, BLACKWOOD, 1919. 1818

A sort of supplement to the "History of European thought in the nineteenth century", answering various objections made to it. G. S.

25. — PHYSICS

Bragg, Sir William. The world of sound. Six lectures delivered before a juvenile auditory at the Royal Institution, Christmas, 1919. viii + 196 p. London, BELL, 1920. 1818

Michaud, Félix. Énergétique générale. vii + 229 p. Paris, GAUTHIER-VILLARS, 1921. 1818

Rey, A. La contribution que les divers pays ont donnée aux progrès de la physique. Première partie: Physique Newtonnienne et physique de FRESNEL MAXWELL CLAUSIUS. Deuxième partie: Physique énergétique et physique électronique. [*Scientia*, xxix, 1^{er} mai et le 1^{er} juin 1921; 345-360; 429-442]. L. G. 1818

Singer, Charles. Steps leading to the invention of the first optical apparatus. *Studies in the history of science*, vol. II, 385-413, 533-534. Oxford 1921. 1818

A very clear summary of the whole history: 1. Pre-Euclidean; 2. EUCLID; 3. CLEOMEDES; 4. RUFUS of EPHEBUS; 5. HERO of ALEXANDRIA; 6. PTOLEMY; 7. ALHAZEN; 8. AVICENNA; 9. WITELLO; 10. R. BACON; 11. PECKHAM; 12. Invention of spectacles; 13. Introduction of concave lenses; 14. LEONARDO DA VINCI; 15. FRACASTORO; 16. MAUROLICO; 17. LEONARD DIGGES; 18. FELIX PLATTER; 19. G. B. DELLA PORTA; 20. FABRIZIO AB AQUAPENDENTE; 21. Empirical discovery of the telescope and compound microscope (between 1591 and 1608, probably nearer the later than the earlier date); 22. GALILEO, the effective discoverer of both; 23. KEPLER and M. A. DE DOMINIS. G. S.

26. — PHYSIOLOGY

Roberts, Morley. Warfare in the human body. Essays on method, malignity, repair, and allied subjects. With an introduction by ARTHUR KEITH. xiii + 286 p. London, EVELEIGH NASH Co., 1920. 1818

See W. M. BAYLISS' review in *Nature*, vol. 106, 622-4, 1921. G. S.

Wageningen, J. van. Die Namen der vier Temperamente. *Janus*, t. 23, p. 48-55. Leyde 1918. 1818

This notion of four temperaments developed slowly in antiquity; the four names : *melancholici*, *phlegmatici*, *choleric*, *sanguinei* are not earlier than the 12th cent. G. S.

27. — PREHISTORY

Burkitt, M.-C. A study of early cultures in Europe and the Mediterranean Basin, xx + 438 p. Cambridge University Press, 1921. 1818

Burkitt, M.-C. Prehistoric art in caves and rock shelters. *Nature*, vol. 107, 460-4, London 1921. 1818

Moodie, Roy-L. New observations in paleopathology. *Annals of medical history*, t. II, 241-247. New York 1919. 1818

Tyler, John-M. The new stone age in Northern Europe, xviii + 310 p. London, BELL; New York, SCRIBNER, 1921. 1818

28. — PSYCHOLOGY

Schwarz, Osias-L. General types of superior men. A philosophico-psychological study of genius, talent and philistinism in their bearings upon human society and its struggle for a better social order. Prefaces by JACK LONDON and MAX NORDAU, 435 p. Boston, BADGER, 1916. 1818

Smith, W. Whately. A theory of the mechanism of survival : The fourth dimension and its applications, xi + 196 p. London, KEGAN PAUL, 1920. 1818

29. — RELIGION. HISTORY of RELIGION RELIGION and SCIENCE

Casanowicz, I.-M. Descriptive catalogue of the collection of ecclesiastical art in the United States National Museum. *Proc. of the U. S. National Museum*, vol. 55, p. 605-49, pl. 60-97. Washington, 1919. 1818

This interesting and well illustrated catalogue with brief but sufficient explanations of the signification and use of the various objects, is limited to the ritual branches of Christendom, that is, the Roman Catholic and Eastern Churches (Orthodox, chiefly Russian, and Armenian). There are 263 items. The inclusion of two models relative to the Church of Jesus Christ of Latter Day Saints (Mormons) is an incongruity. G. S.

Hardwick, John Charlton. Religion and science. From GALILEO to BERGSON. ix + 148 p. London, Society for promoting Christian knowledge, 1920. 1818

Little, Andrew George. A guide to Franciscan studies (*Helps for students of history*). 63 p. London, Society for promoting Christian knowledge, 1920. 1818

Roscher, Wilhelm-Heinrich. Der Omphalosgedanke bei verschiedenen Völkern, besonders den semitischen. Ein Beitrag zur vergleichenden Religionswissenschaft, Volkskunde und Archäologie. *Berichte d. Sächs. Gesell. d. Wiss., phil. Kl.*, t. 70, 115 p. Leipzig 1918. 1918

ROSCHER traces the notion of a navel of the Earth among various peoples: Chinese, Turkish, races of S. Siberia, Assyrians and Babylonians, Jews, Moslems, Greeks, Egyptians, Romans, Etruscans, Germans, Celts, California Indians. See also *Isis*, IV, 428, 443. G. S.

Wetter, Gillis P. Phōs (Φῶς). Eine Untersuchung über hellenistische Frömmigkeit zugleich ein Beitrag zum Verständnis des Manichäismus. *Skrifter utgifna af K. Humanistika Vetenskaps-Samfundet*, t. 17, iv + 189 p. Uppsala 1915. 1915

1. Das Licht physisch gedacht; 2. Das Licht für mehr religiöse Vorstellungen; 3. Herkunft der Lichtgedanken. G. S.

30. — SCIENCE

B. — History.

Cattell, J. McKeen and Brimhall, Dean R. American men of science. A biographical directory. Third edition, viii + 808 p. 4°. Garrison, New York. The Science Press 1921. [Ten dollars]. 1918

The first ed. (1906) contained c. 4000 biographies, the second (1910) c. 5500. The present ed. contains c. 9500, and this increase in the main measures the increase in the number of scientific men. This directory is truly admirable and should be taken as a model in other countries. P. 771-780 contain a list of the American men of science who died between 1903.01.01 and 1920.12.31. The book ends with a study by CATTELL on "Families of American men of science" (reprinted from *Popular Science Mty.* May 1915, and *Scientific Mty.*, March, Oct. 1917). This study is not out of place, as it may seem at first view, for it emphasizes the fact that a directory of this kind, however great its immediate and practical utility may be, serves also a higher purpose. The authors of this excellent book have rendered a high service to American science: it will be more fully appreciated a hundred years hence. G. S.

Johnson, E. H. Some observations concerning the history of science. *School science and mathematics*, t. 21, p. 450-453, May 1921. 1918

Matschoss, Conrad Das Deutsche Museum in München. Ein Haus für die Meisterwerke der Naturwissenschaft und Technik. [Undated reprint from *Industrie und Technik*. 5 p., 11 illustr.]. 1918

A general and popular account of the Museum. G. S.

Rey, Abel. Revue d'histoire des sciences et d'histoire de la philosophie dans ses rapports avec les sciences (année 1920). *Revue de synthèse historique*, t. 31, p. 121-135. Paris 1920. 1918

This paper is quoted chiefly because its ambitious title might mislead the reader. It deals neither with the history of science as a whole nor with the year 1920, and the author's choice is somewhat capricious. The authors dealt with are P. TANNERY (1912), P. DUBREIL (1913-1917), JOHN

BURNET (1919), P. BOUTROUX, FL. CAJORI (1919), HALSTED, CHILD, M. DELACRE. G. S.

C. — Organization.

Kaye, George William Clarkson and Laby, T. H. Tables of physical and chemical constants and some mathematical functions. 4th ed. VIII + 161 p. London, LONGMANS, 1921 (1st ed., 1911). 1818

Mills, John. The realities of modern science. An introduction for the general reader, x + 327 p. New York, MACMILLAN, 1919. 1818

Soddy, Frederick. Science and life. Aberdeen addresses, XII + 230 p. London, JOHN MURRAY, 1920. 1818

D. — Philosophy.

Campbell, Norman Robert. Physics. The elements, x + 565 p. Cambridge, University Press, 1920. 1818

Part I. The propositions of science : 1. Subject matter of science; 2, 3. Nature of laws; 4. Discovery and proof of laws; 5. Explanation of laws; 6. Theories; 7. Chance and probability; 8. Meaning of science; 9. Science and philosophy.

Part II. Measurement : 1. Fundamental measurement; 2. Physical number; 3. Fractional and negative magnitudes; 4. Numerical laws and derived magnitudes; 5. Units and dimensions; 6. Uses of dimensions; 7. Errors of measurement, methodical errors; 8. Errors of consistency and the adjustment of observations; 9. Mathematical physics. Index.

Driesch, Hans. Über die grundsätzliche Unmöglichkeit einer « Vereinigung » von universeller Teleologie und Mechanismus. *Sitzungsberichte der Heidelberger Akad. d. Wiss., philos. hist. Kl.*, t. V, 1914, 18 p. 1818

Jenkinson, J. W. [1871-1915]. Science and metaphysics. *Studies in the history of science*, vol. II, 447-471. Oxford 1921. 1818

Marvin, F. S. Science and the unity of mankind. *Studies in the history and method of science*, vol. II, 344-358. Oxford 1921. 1818

MARVIN explains that science is essentially of a social nature; he then shows that its growth has been accompanied by a closer knitting up of the world as one community; finally he considers the actual links which science has forged for the process of unification and what it may do in the future to hasten it. G. S.

Schiller, F. C. S. Hypothesis. *Studies in the history and method of science*, vol. II, 414-446. Oxford 1921. 1818

33. — SUPERSTITION and OCCULTISM

Leclerc, Henri. La médecine des signatures magiques. *Janus*, t. 23, 5-28. Leyde 1918. 1818

Ce travail a été attribué par erreur à LECLERC, c'est l'œuvre de SAINTYVES (voir *Janus*, t. 24, 192). G. S.

Redgrove, H. Stanley. Bygone beliefs. Being a series of excursions in the byways of thought, xvi + 205 p., 32 pl., 53 fig. London, RIDER, 1920. 1815

These collected essays have been partly published in *The Journal of the Alchemical Society* and in *The Occult Review*, which will suffice to indicate their character: 1. Some characteristics of mediæval thought; 2. PYTHAGORAS and his philosophy; 3. Medicine and magic; 4. Superstitions concerning birds; 5. The powder of sympathy; 6. The belief in talismans; 7. Ceremonial magic in theory and practice; 8. Architectural symbolism; 9. The quest of the philosopher's stone; 10. The phallic element in alchemical doctrine; 11. ROGER BACON; 12. The Cambridge platonists.

G. S.

Rivière, Émile. Légendes et superstitions thérapeutiques. *Bull. soc. franç. méd.*, t. 13, 82-94, 160-171, 385-443. Paris 1914-1919. 1814

35. — ZOOLOGY

Fuertes, Louis Agassiz. Falconry, the sport of kings. *The national geographic magazine*. Vol. 38, 429-460, illustr. Washington, December 1920. 1815

Falconry or hawking goes back to the early days of Egypt. It was practised by the Persians; the Lombards of N. Italy knew of it c. 560; by 875 it had become a generally known practice throughout W. Europe. This article by the master birdpainter FUERTES is of great interest because of the illustrations (many in color) showing very clearly how the birds strike their victims, and of the explanations of the gear and trappings used in falconry and the falconer's names for the parts of a hawk.

G. S.

McClymont, James R. Essays on early ornithology and kindred subjects, 35 p., 3 pl. London, QUARITCH 1920. [200 copies]. 1815

Six essays: 1. The rukh of MARCO POLO (an imaginary bird); 2. The penguins and the seals of the Angra de Sam Brás (nr. the Cape of Good Hope, apropos of the "Roteiro da Viagem de VASCO DA GAMA em 1497" - (the second record of an important voyage of discovery containing information on natural history, the first being the journal of the first voyage of COLUMBUS); 3. The Banda islands and the Bandan birds; 4. The etymology of the name Emu (may be of Arabic origin, ne'ama', or of Portuguese origin, hema 1576); 5. Australian birds in 1697 (apropos of the Dutch voyage under WILLEM DE VLAMING); 6. New Zealand birds in 1772 (apropos of NICOLAS THOMAS MARION DUFRESNE's voyage; CROZET, second in command of the Mascaret, made not a few ornithological observations). G. S.

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Louis Hémon. — *Maria Chapdelaine*. Montréal, J. A. Le Febvre, 1916.

Gustaf af Geijerstram. — *The book about little brother*. New York, American Scandinavian Foundation, 1921.

Lytton Strachey. — *Queen Victoria*. London, Chatto and Windus, 1921.

Lytton Strachey. — *Eminent Victorians*, London, Putnam, 1918.

Serge Aksakoff. — *A Russian gentleman*. London, Arnold, 1917.
(Published in Russian in 1846-1856, under the title : *Family history*.)

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Richard Wallingford

(1292?-1335)

RICHARD OF WALLINGFORD, Abbot of St. Albans, was the son of WILLIAM, a smith of Wallingford, and his wife ISABELLA. WILLIAM died when the boy was scarcely ten years old. A few years later, on account of his good character and mental ability, RICHARD was adopted by WILLIAM DE KIRKEBY, Prior of Wallingford, and by him sent to Oxford. After six years at Oxford he was graduated at the age of twenty-three with the A. B. degree. He then assumed the monastic habit at the Monastery of St. Albans. Three years later he returned to Oxford and after nine years of indefatigable study of philosophy and theology he received the degree of Bachelor of Divinity and was licensed to lecture in the Sentences (1). While he was on a visit to St. Albans, Sept. 7, 1326, (2) apparently the year of his graduation in theology, death overtook Abbot HUGH DE EVERSDON. On Oct. 29 Richard preached before the Convent and was elected over RICHARD DE TRENGE who had preached on the preceding day. After the usual formalities, some delay, and the expenditure of 953L. 10s. 11d. in connection with his visit to Avignon and induction into office by the pope, he entered upon his duties as abbot. Afflicted with leprosy from the beginning of his abbacy, RICHARD was soon blind in one eye and by 1332 was almost bereft of the power of speech. Moreover in this time of general lawlessness Abbot HUGH had been lax and extravagant and had sur-

(1) *Gesta Abbatum Monasterii Sancti Albani a Thoma Walsingham, regnante Ricardo Secundo, eiusdem ecclesiae praecentore compilata*, ed. RILEY, vol. 2, p. 181-182. WALSINGHAM wrote this account some sixty years after WALLINGFORD's death.

(2) The *Dictionary of National Biography*, vol. XLVIII, p. 205-207, contains the best account in English of WALLINGFORD's life and work. In it, however, the above date appears as Sept. 7, 1327, and the date of his death as May 23, 1336, instead of May 23, 1335, given in the *Gesta*.

rendered to the townsmen a charter of liberties. Consequently RICHARD had to contend not with physical limitations only but also with the townsmen and with his own monks. After much litigation he regained the charter in 1332. In fact he won most of his numerous law suits against the townsmen, and he succeeded in effecting his rule over his monks though some of them entered a conspiracy against him. The activities of his enemies, however, brought on a papal inquiry which resulted in his appointing his prior, NICHOLAS FLAMSTEDE, coadjutor. On Nov. 19, 1334, his chamber was set on fire by lightning. As a consequence his malady grew rapidly worse until his death a few months later, May 23, 1335 (1).

WALSINGHAM describes RICHARD thus : « In prosperity circumspect and timid, in adversity he was patient and magnanimous; in all things and toward all men, both in word and by example, thoughtful and obliging.... So great was his grace and learning that in the liberal sciences and mechanic arts he surpassed the great masters, and he excelled his own attorneys in legal acumen.... Also he used to forecast the weather and predict many other future events.... His reputation for sternness, partly due to his infirmity but mostly to the laxness of his predecessor, was greater than he deserved.... No acquaintance or stranger avoided him on account of his leprosy but rather they used to come from afar to enjoy his sanctity and learning (2). Yet we read, « The Abbot gives four books of the Convent to RICHARD DE BYRI (BURY), Keeper of the Privy Seal, to promote the interests of the Convent at the Court. Thirty-two books are sold to him for 50 pounds of silver; half of which the Abbot keeps » (3). However, the Bodleian Laud. MS. Misc. 264, containing some of the works of St. ANSELM, was presented by RICHARD to the Abbey of St. Albans (4).

RICHARD made considerable repairs and erected new buildings but he considered his greatest work the clock « Albion » (all-by-one) which showed the times and seasons and the courses of the sun, moon and planets. While on a visit to St. Albans King EDWARD III censured RICHARD for spending so much money on this clock instead of putting it into a church. RICHARD replied that there would be many abbots

(1) *Gesta*, p. 183, 184, 188, 284-286, 289, 293.

(2) *Gesta*, p. 201, 207, 208.

(3) *Gesta*, p. 200.

(4) *Dict of Nat. Biog.*

after him who could build churches but none who could complete the clock (1).

Of RICHARD's extant writings, all in manuscript form, a list of twelve is recorded in the *Dictionary of National Biography*. The following relate to mathematics and astronomy.

I. « Canones de instrumento.... Albion dicto », beginning « Albion est geometricum instrumentum ». MSS. [Harley 80 in British Museum]; Laud. Misc. 637 in Bodleian Library; Corpus Christi College, Oxford, 144; Cambridge University Library, Mm. III-2.

II. « De arte componendi rectangulum », beginning, « Rectangulum in remedium ». MSS. Laud. Misc. 637; [Digby 168, f. 61]; C.C.C. Oxford, 144; Cambridge U. Lib., Ee III 61, f. 6; Harley 80, f. 54.

III. « Ars operandi cum rectangulo ». MSS. Laud. Misc. 637 [Harley 80].

IV. « Quadripartitum de sinibus demonstratis ». MSS. Digby 168, f. 1; [178, f. 15]; 190, f. 90.

V. « De sinibus et arcubus in circulo inveniendis ». [MS. Digby 178, f. 39.]

VI. « Exafrenon prognosticorum temporis », beginning, « Ad perfectam noticiam ». MSS. [Digby 180, f. 30]; 194, f. 35; Cambridge U. Lib. I 1, f. 25. [MS. Digby 67, ff. 6-12] is an English translation. In Digby Roll 3 is another translation of chapters 1-5. The University of Michigan Library possesses photostat copies of the manuscripts bracketed in the above list.

MS. Digby 178 ff. 15-38 was used in the preparation of this dissertation. It bears the superscription, « 147 Joannes Dee 1559 ». (2)

There are numerous marginal annotations in a different hand from that of the body of the manuscript. In fact there were two authors of the annotations, the latter of whom always wrote LEWYS (3) at the beginning of his comment. The manuscript proper ends thus : « Explicit quartatus tractatus de corda recta et versa quem composuit Frater RICARDUS WALLINGFORDE quondam Abbas Sancti Albani ac prius socius Collegii WALTERI DE MERTON Oxonie, summus astronomus ac

(1) *Gesta*, p. 282.

(2) JOHN DEE (1527-1608, London), a very learned but eccentric man, was a great collector of manuscripts. There still exist two original copies of the catalogue of his collection.

(3) Probably LEWIS CARLEON who, about 1485, expanded WALLINGFORD's « Eclipsium tabula ». (Index of SLOANE MSS. in British Museum.

geometer eximius, cuius anime Deus procipietur excelsus. » The SAVILE and WILSON catalogues support the above statement that WALLINGFORD was a fellow of MERTON College but none of the existing records of the colleges verifies the fact. He was supported in his undergraduate years by KIRKEBY (1) and, according to LYTE, he was a student at Gloucester College (2). Furthermore a statute forbade the granting of MERTON fellowships to members of holy orders (3) though at this time it seems to have fallen into desuetude. « MERTON continued to maintain undisputed supremacy among the Oxford colleges for two centuries after its foundation (1264), and during the XIVth century may almost be said to have stood alone in Oxford. » (4) The records of his life and work and also the style of the *Quadripartitum* indicate that WALLINGFORD was a teacher. The fact that he was the most celebrated English mathematician of his day thoroughly favors his connection with MERTON. We may conclude that he was at least well acquainted with his contemporaries in this college.

Two of these teachers were THOMAS BRADWARDIN (1290-1349), later Archbishop of Canterbury and entitled « Doctor Profundus », and JOHN MAUDUITH (taught 1306-1340 ?). BRADWARDIN wrote *Tractatus de proportionibus*, *De quadrature circuli*, *Arithmetica speculativa*, and *Geometria speculativa*. MAUDUITH wrote *Tabulo Mauduith facto in Oxon*, 1310, which contains four tables : « De chorda et arcu recto et verso, et umbris », « De arcu aequinoctiali elevato, et horis et arcu diei », « De altitudine stellarum et arcu diurno, et distantia ab equinoctio », « De ascensionibus regionis triae ». There is nothing in BRADWARDIN's work closely related to the *Quadripartitum*. MAUDUITH's *Parvus tractatus* may have been the inspiration for the *Quadripartitum*, because it covers practically the same ground but treats the theory in contemporary style. On folio 60b we find, « Oportet investigare proporcionem sinus ad sinum », followed by some definitions and six propositions on proportion, but nothing resembling WALLINGFORD's Part I. JOHN ASHINDON or EASTWOOD who became a fellow in 1338, is called by ANTHONY WOOD the greatest mathematician and astronomer ever produced by MERTON College. He published treatises

(1) « ... cuius eleemosynarum ope suffultus grammaticam et philosophiam Oxoniis didicit, circiter per sex annos. » (*Gesta*, p. 182.)

(2) LYTE : *History of the University of Oxford*, London, 1886, p. 104.

(3) BRODRICK : *Memorials of Merton College*, Oxford, 1885, p. 7.

(4) BRODRICK, p. 33.

in his own name and in collaboration with his brother fellow WILLIAM REDE. From him WOOD dates a hundred and fifty years of mathematical and astronomical activity at MERTON, but says that nearly all the works of this period disappeared from the College library early in the reign of EDWARD VI when no less than a cartload of books on natural science were either burned or sold as waste paper (1). Doubtless the records of the direct influence of WALLINGFORD's mathematical labors were thus destroyed.

WALLINGFORD's « *Ars operandi cum rectangulo* » ends thus : « ... eodem tempore quo composuimus Albeon, hoc est sub annis Christi 1326 ». It is related (2) that he often expressed regret at having devoted to the study of arithmetic, astronomy, geometry and music so much time that ought to have been spent in the study of philosophy and theology. These statements and the facts of his life indicate that his mathematical works were produced during his residence at Oxford and hence not later than 1326.

The meager published remains of the mathematical works accessible to WALLINGFORD do not enable us to reach conclusions wholly definite as to his sources of information and therefore the amount of independent investigation in the *Quadripartitum* can not be dogmatically stated. But internal evidence seems to warrant the conclusion that in the construction of Part I, with which we are here specifically concerned, he needed little material other than EUCLID's *Elements*, PTOLEMY's *Almagest* and AZ-ZARQALI's *Toledo Tables*. Of the last two works he probably possessed the translations by GERARD OF CREMONA. Although we are unable to explain certain discrepancies in the numbers he assigns to a few propositions, two facts suggest his acquaintance with CAMPANUS' EUCLID. His colleague BRADWARDIN opens his *Geometria speculativa* with the statement that it was compiled from the works of EUCLID, BOETHIUS and CAMPANUS, and WALLINGFORD's own work on the rectangle is headed, « Explicit theórica CAMPANI de civitate nonaria... » We have not found WALLINGFORD's geometric figures in any other work nor in any similar medieval production do we find such Euclidean rigor in the demonstration of propositions. The Arabic authors whose works were then accessible had taken a middle ground between the mere rules of the Hindus, as found in the

(1) BRODRICK, p. 200.

(2) *Gesta*, p. 182.

Siddhantas, and the rigorous methods of the Greeks. The commentators on, as well as the translators of, these Arabic works generally followed the same procedure, that is, they simply recorded without proof the principal steps the Greeks would have taken in the proof of a proposition. In a few of the manuscripts of this period edited by CURTZE the authors sometimes append to a statement the remark, « EUCLIDES demonstrat » or « ut docet EUCLIDES ». To be sure the author of « De tribus notis » refers to definite theorems of EUCLID and JABIR but this treatise is really only a compilation from these two sources. In Part I WALLINGFORD cites more than thirty theorems from 7 of the 13 books of EUCLID. With his thorough knowledge of his subject matter and the methods of EUCLID, he built up a logical trigonometric structure, by no means an unworthy contribution to the development of the science. Further evidence of independence here is the citation, in his proofs, of his own previously demonstrated propositions.

Let us look at the propositions of Part I. The equivalents of 1, 3, 5 are found in the *Canones* of AZ-ZARQALI, and 2, 4 are the converse propositions of 1, 3. 7 is the application of PTOLEMY'S Theorem to finding the chord of the sum of three arcs instead of two, followed by corollaries. Proposition 8 is a simple method of finding the sine of the difference of two arcs independently of PTOLEMY'S Theorem: the resulting formulas are very interesting. Propositions 9 and 10 give further evidence of the author's determination to secure rigorously logical results. Proposition 12 is apparently the first extension of the sine to arcs exceeding 180° . In 13 we have the relation of $\sin \alpha$ to $\text{versin } (90^\circ \pm \alpha)$ and $\text{versin } \alpha$ to $\sin (90^\circ - \alpha)$.

In the work of LEVI BEN GERSON are the equivalents of the formulas of 13 and the second formula of 8 but this work was written in Hebrew in 1321 and was translated into Latin 7 years after WALLINGFORD'S death. Granting, however, that he read this excellent treatise of LEVI BEN GERSON'S, he chose only the parts that suited his purpose and then modified them to fit the scheme of his own treatise.

We shall now summarize the results of our study. We found a trace of plane trigonometry among the Egyptians. The Hindus contributed conceptions which, like that of the sinus, lent themselves to the purposes of calculation. The Greeks contributed a very logical trigonometry of chords. But is remained for the Moslems to blend the product of the arithmetic sense of the Hindus with that of the logical

sense of the Greeks and thus to lay the foundation for the further development of the science. The East Moslems wrought out a complete independent science of trigonometry but this work did not reach Europe. Hence the Europeans were left to build upon the work of the Moslems of Spain who failed by about two centuries to keep pace with their brothers of the East. By the opening of the fourteenth century the West Moslem works had been translated and digested and independent activity among the Latin writers had begun. It was natural that the loose methods employed at that time should rouse to activity some student of the *Elements*. Such a student was WALLINGFORD and the result is the *Quadripartitum*. This treatise undoubtedly initiates a new era in Europe both in the complete and separate treatment of trigonometry as a unified basis for astronomical calculation and also in making this treatment conform to the logical methods demanded by mathematical science. In REGIOMONTANUS' « De triangulis » we have the fruition of the two ideas : the work of the Babylonians, the Egyptians, the Greeks, the Hindus, the Moslems, and the medieval Europeans had reached its culmination.

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JOHN DAVID BOND.

L'Évolution du règne métallique d'après les Alchimistes du XVII^e siècle

Nous allons, dans les pages suivantes, tenter de donner une idée de la place que tenait la philosophie des métaux dans la théorie chimique au cours du XVII^e siècle. Il ne s'agit pas, bien entendu, d'entraîner le lecteur dans le labyrinthe mystérieux où les chercheurs de la pierre philosophale, charmés sans doute par la grandeur impressionnante de leur rêve, venaient se perdre ! Nous ne discuterons pas un instant avec les illuminés qui croyaient facilement réaliser le Grand OEuvre ; mais nous essayerons d'entrevoir quels motifs irrésistibles les portaient, malgré de nombreuses déceptions, à s'obstiner à résoudre cet insoluble problème : la transmutation des métaux imparfaits en or incorruptible ! Les adeptes, par une illusion invincible et sans cesse renaissante, se croyaient perpétuellement à la veille d'atteindre le but tant désiré qui leur échappait constamment et paraissait toujours à leur portée ; ils persistaient malgré les échecs répétés, les ruines, les moqueries et les ennuis innombrables, à courir après cette chimère. Certes, l'amour-propre qui croit pouvoir lever tous les obstacles, l'ambition d'être plus savant ou plus riche que les autres, le désir de faire partie d'une secte peu nombreuse et admirée, l'attrait du mystère et du romanesque, le goût des aventures et de la spéculation, quelques espoirs vagues et indéterminés, la charlatanerie et la superstition, bref toutes ces passions qui sans cesse agitent les hommes ont sans doute contribué à affermir un grand nombre de vocations et peut-être en ont-elles provoqué quelques-unes ; mais enfin ces obscures tendances qui ont joué un si grand rôle dans l'histoire des actions humaines ne sauraient, quelle que soit leur force, expliquer à elles seules la persistance d'un effort continu vers une découverte sensationnelle sur laquelle les savants, malgré leur consciencieux travail, venaient toujours achopper ! Les passions n'agiraient pas longtemps dans le même sens si elles ne rencontraient quelque complice dans l'esprit de ceux qui se laissent

séduire par elles; les espoirs tenaces des alchimistes trouvaient une alliée bien autorisée dans la théorie scientifique, œuvre de l'intelligence humaine. Ils étaient pour ainsi dire appelés par cette théorie et leur disparition, nous le verrons, coïncida avec sa ruine.

* * *

Que les métaux forment une classe naturelle de corps, ayant plus d'analogie entre eux qu'avec tous les autres corps connus, c'est ce qui apparaît clairement à nos sens, sans qu'il soit utile de justifier par des arguments cette impression toute physique. Que ces analogies aient une signification profonde, dépassant infiniment cette première vision expérimentale, c'est une chose sur laquelle les chimistes se sont accordés, sans discussion, bien qu'ils n'aient su se mettre d'accord sur la véritable cause de ces analogies! Pour comprendre donc la pression irrésistible que la vue de ces substances semblables et remarquables a produite pendant longtemps sur l'esprit humain, il nous faudra rechercher quelle valeur les savants du xvii^e siècle donnaient aux classifications. Et d'abord, il nous faudra rappeler les antiques croyances astrologiques, nées à une époque où l'astronomie était la seule science réellement constituée et où toutes les particularités du monde sublunaire se modelaient sur les mouvements apparents des astres, croyance dont l'influence atténuée a persisté jusqu'alors. Les anciens donc, et PARACELSE après eux, frappés par l'éclat et la pesanteur des corps métalliques, ont essayé d'établir entre les sept métaux qu'ils avaient isolés : l'or, l'argent, le vif-argent, le cuivre, le fer, l'étain, le plomb, et les sept astres errants : le soleil, la lune, Mercure, Vénus, Mars, Jupiter et Saturne, une correspondance harmonique. A chaque corps d'une de ces catégories correspondait un corps de l'autre catégorie. Sans qu'il y eût liaison directe entre les métaux et les planètes, on pouvait résumer par un même signe les propriétés des uns et des autres. Mais là ne s'arrêtait pas la science. Entre les astres errants, par exemple, et les différentes parties du corps humain régnait, d'après les médecins, une harmonie analogue... d'où cette théorie de la guérison qui semble assez bien construite quand on en possède la clef : que pour chaque maladie de l'homme, chaque désharmonie accidentelle d'un organe, le remède approprié se trouve être le métal en rapport avec la planète qui correspond à l'organe souffrant. Nous n'entrons pas plus avant dans l'examen de cette théorie qui paraît aujourd'hui si étrange, mais qui cependant a joué un rôle prépondérant dans

la formation de la science d'autrefois... D'ailleurs, si, au xvii^e siècle, les analogies astrologiques étaient très nettement indiquées dans les ouvrages de métallurgie ou de pharmacie, elles n'exerçaient plus cependant un attrait irrésistible sur l'esprit des savants et elles étaient librement discutées. Les discussions des astronomes concernant le système du monde, les découvertes dues au télescope avaient laissé l'impression que l'astronomie n'était pas une science achevée, que même si le monde céleste était analogue au monde terrestre, la science des astres, actuellement imparfaite, ne pourrait servir que de guide imparfait à l'étude des corps métalliques!... Écoutons, pour nous en rendre compte, le scepticisme indifférent de BARBA (1) : « Cette subordination des métaux est aussi incertaine que leur nombre. On peut « présumer avec raison qu'il y a dans l'intérieur de la terre plus d'es- « pèces que nous n'en connaissons. Il n'y a pas longtemps que l'on « a trouvé le bismuth dans les montagnes de Bohême. C'est un métal « moyen entre l'étain et le plomb, différent de tous les deux, et peu « connu. Il peut y en avoir plusieurs autres. Quand on voudra même « attribuer quelque pouvoir secret à la subordination, et au rapport « qu'on imagine entre les planètes et les métaux, ce n'est pas aujour- « d'hui une chose assurée que les planètes soient limitées au nombre « de sept. Le télescope en a fait découvrir d'autres. Il n'y a qu'à voir « pour cela le traité des satellites de Jupiter par le célèbre GALILÉE; « on y trouvera le nombre et les mouvements de ces nouvelles planètes « marqués avec des observations très curieuses. »

D'une manière générale donc, et malgré quelques phrases traditionnelles que la force de l'habitude laissait écrire dans leurs ouvrages, les chimistes abandonnèrent peu à peu l'idée que l'harmonie des astres devait être semblable à celle de leur science. Par contre, ils laissèrent aux influences célestes, aux effluves divers venus des étoiles et rencontrant la matière terrestre, une place prépondérante dans la formation des corps que nous connaissons et tout spécialement des métaux. « L'influence du ciel comme cause universelle ne concourt pas « moins à la formation des métaux qu'à la génération de tous les « autres êtres de l'univers. Toutes ces productions cependant deman- « dent une cause plus prochaine qui, par sa jonction avec les « influences célestes, agisse sur leur propre matière... Cette cause « prochaine ou cette vertu minérale s'aide principalement du froid

(1) BARBA, *Métallurgie* (1^{re} édition espagnole 1640). Cité d'après la traduction française de 1751, p. 83.

« et du chaud comme d'instruments propres à la formation des métaux. »

Cette manière de voir semble dicter les conclusions suivantes : les divers métaux ont une origine analogue et sont tous de formation semblable; loin d'être essentiellement différents, ils ne représentent que les aspects du même être à des stades successifs de son développement! C'est ce qu'ont vu nombre de philosophes et d'alchimistes : « CALLISTÈNE, ALBERT LE GRAND et d'autres philosophes disent qu'il n'y a qu'une seule espèce de métal parfait qui est l'or, dont les autres métaux, selon eux, ne sont que les commencements ou les principes; c'est pourquoi on peut les réduire à leur dernière perfection et les changer en or. » Seulement, cette opinion n'est pas universellement admise. « Ceux qui nient la possibilité de la transmutation des métaux s'efforcent de prouver qu'ils sont des espèces distinctes; d'où ils concluent que la transmutation est impossible... J'avoue que leur sentiment est assez plausible, parce que leur définition générique convient également à tous, soit pour des propriétés particulières qui conviennent également à chacun d'eux, soit pour leur durée permanente sans aucun effort de la nature pour leur donner la dernière perfection de l'or. On peut encore à ces raisons en ajouter beaucoup d'autres. Cependant, l'opinion de CALLISTÈNE et d'ALBERT LE GRAND n'est pas moins probante. Ce n'est pas un argument décisif que deux choses soient des espèces distinctes parce qu'une définition ne convient pas à toutes les deux. Il faut montrer la différence essentielle qui constitue spécialement leurs différents êtres. On ne peut inférer que l'homme et le lion sont de différentes espèces parce qu'ils sont compris sous le genre animal; il n'y a que la différence essentielle de raisonnable et d'irraisonnable qui limite le genre; autrement, il s'ensuivrait que PIERRE et PAUL sont d'espèces distinctes.

« Ainsi, quoique la définition de métal convienne à l'argent et au plomb aussi bien qu'à l'or, on ne peut pas conclure de là que ce soient des espèces distinctes; car, sous la même espèce, l'or peut être parfait et tous les autres imparfaits, comme l'enfant l'est à l'égard d'un homme; et comme l'enfant peut se perfectionner et qu'il est virtuellement tout ce que peut être un homme dans sa maturité, les métaux sont de même à l'égard de l'or. Les propriétés différentes qu'on voit dans les métaux ne prouvent donc rien; ce sont des accidents qui accompagnent l'état de leur imperfection et qu'on peut

(1) BARBA, *op. cit.*, p. 75.

« leur ôter. L'imperfection qu'ils ont vient ou de l'avarice des hommes
 « qui les arrachent de la mine avant leur maturité, ou de la lenteur de
 « leur production et de leur amélioration. Nous ne pouvons pas obser-
 « ver ce qui regarde leur progrès, comme on ne voit point croître les
 « arbres et les plantes que nous n'apercevons que quand ils sont élevés
 « de terre » (1).

Nous trouverions les mêmes arguments concernant la « possibilité » de la transmutation métallique chez un grand nombre de savants du XVIII^e siècle, qu'ils se soient ou non adonnés à la recherche du Grand Œuvre. Le plomb, nous dit-on, est à l'or ce que le fruit vert est au fruit mûr, ce que l'enfant est à l'homme. Et comme, dans la plupart des cas, nous voyons les fruits mûrir et les enfants grandir, nous admettons sans difficulté que les métaux imparfaits se transformeraient en or s'il se rencontrait dans la nature des circonstances favorables à leur progression! « La transmutation des métaux, dit ETTMULLER (2), n'est
 « point un non-être, quoique la plupart des chimistes pensent le con-
 « traire : car s'il est vrai... que tous les métaux... ne diffèrent entre eux
 « que par le degré de fixité et de maturité, n'est-ce pas une chose
 « possible de perfectionner les métaux imparfaits par le moyen de
 « l'art? » Bien plus, nous fait observer SALOMON (3), il faut nécessairement avouer que l'intention de la nature, en produisant les métaux, n'est pas de faire du plomb, du cuivre, de l'étain, ni même de l'argent, quoique ce métal soit dans le premier degré de perfection, mais de l'or (4). « Nous avons dit être imparfaites, pensent les alchimistes, les
 « choses qui sont en voie de parvenir à la forme qui leur est destinée
 « et parfaites quand elles y sont parvenues. » L'analogie avec le développement du fruit ou de l'enfant est là, saisissante.

« De sorte que s'il ne se trouvait pas d'empêchement au dehors
 « qui s'opposât à l'exécution de ce dessein, toutes ces productions
 « seraient achevées et elles seraient toujours autant de chefs-d'œuvre,
 « parce que toutes ces opérations seraient toujours fort justes et fort
 « régulières. C'est pourquoi nous devons considérer la naissance des
 « métaux imparfaits comme celle des avortons et des monstres qui

(1) BARBA, *op. cit.*, p. 76.

(2) ETTMULLER, *Traité de chimie raisonnée*, Lyon, 1693, p. 448. Plusieurs éditions latines et allemandes avaient déjà paru.

(3) SALOMON, *Préface à la bibliothèque des alchimistes*, 1^{re} édition. Paris, 1672. Cité d'après l'édition de 1741, p. xxviii.

(4) DUCHESNE, *Œuvres*. Paris, 1624, p. 135.

« n'arrive que parce que la Nature est détournée de ses actions et qu'elle trouve une résistance qui lui lie les mains, et des obstacles qui l'empêchent d'agir aussi régulièrement qu'elle a coutume de faire. » (1) L'alchimiste donc, en essayant d'obtenir par l'art ce qui se fait naturellement en un temps beaucoup plus long, en essayant tout au moins de réaliser une transformation qui a une tendance à se produire, même sans son action, n'agit pas absolument au hasard. Il aura quelque peine à admettre que l'or n'ait pas été produit en un instant; il demandera l'origine des « résistances » qui sont opposées au développement de ce précieux et admirable métal. Mais des difficultés analogues se rencontreraient, semble-t-il, dans nombre de théories scientifiques dont personne ne songe à sourire. « Les métaux imparfaits, dit HERMITE (2), ont une naturelle disposition à recevoir la forme des métaux parfaits, soit dans les entrailles de la terre par la seule Nature et dans un long espace de temps, soit sur la terre par la même Nature secondée de l'Art et dans un Instant. »

Il est inutile de multiplier les citations; nous venons d'atteindre le fondement métaphysique sur lequel s'appuyait la foi de l'alchimiste. Sur un terrain qu'ils croyaient stable, les adeptes creusèrent les fondations qui servirent pendant longtemps de support inébranlable à leur fragile et éphémère construction. Ils ont posé comme évident que les métaux imparfaits produits par une limitation accidentelle du pouvoir de la Nature ont une tendance à se transmuier en or; qu'ils contiennent de l'or en puissance; mais que cet or ne se réalise actuellement qu'après une longue période de temps, à moins que le métal ne se trouve soumis à certaines influences qui rendent la transformation rapide! Découvrir les conditions les meilleures pour que la transmutation se produise pleinement et parfaitement, tel est le programme du philosophe hermétique. Le principe fondamental de l'alchimie qui fixait si bien le sens et la signification du devenir dans le règne métallique en ne laissant indéterminée que la durée variable de son infaillible évolution éclaire d'un jour nouveau cet art dont l'idée seule paraît aujourd'hui si étrange et sur lequel plane une obscurité mystérieuse.

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(1) SALOMON, p. xxviii.

(2) HERMITE, *Aphorismes chimiques*, Paris, 1692, p. 63, 64, 65.

Nous savons que d'après la théorie alchimique les transmutations sont non seulement possibles, mais certaines, qu'elles se font dans un sens déterminé, toujours le même, et qu'elles aboutissent forcément à donner aux métaux imparfaits l'admirable forme de l'or. Par quel procédé technique les philosophes hermétiques vont-ils aider la Nature à réaliser rapidement le but qu'elle s'est proposé : mûrir rapidement les métaux afin qu'ils prennent la pesanteur et la couleur de l'or ? Tel est le problème qui se pose maintenant à notre esprit. Les termes en sont fort clairs, mais les solutions proposées semblent tellement variables, elles sont entachées de tant d'obscurités accidentelles ou voulues, le langage qui les exprime ne nous est guère accessible, et nous risquons de mal interpréter une pensée qui cherche à se dérober et qui s'enveloppe de mystère. D'ailleurs, les alchimistes ont pris soin de nous avertir qu'ils ne parlent que pour les « enfants de l'Art ». Ces privilégiés qui seuls peuvent comprendre la signification profonde de leurs écrits dont le sens est très éloigné de la langue vulgaire ont reçu du Ciel une inspiration particulière ! Cette inspiration leur permet de saisir sous les métaphores qui étonnent ou éblouissent notre imagination, sous les apparentes extravagances qui déconcertent notre raison, la trame logique du raisonnement qui comme « le fil d'Ariane les guide sûrement au travers des détours du labyrinthe hermétique » (1). Nos philosophes, par ces discours, voulaient-ils faire comprendre à leurs lecteurs que la science ne s'acquiert qu'après un effort intense, continu, suivi et par là écarter de la pratique de leur art sacré les gens frivoles ou superficiels, indignes d'arriver à obtenir par leur labeur un résultat sérieux ? Croyaient-ils véritablement qu'une révélation est nécessaire pour achever d'instruire pleinement ceux qui désirent s'adonner à la recherche du Grand Œuvre ? Ou encore, comme d'irrévérencieux sceptiques le leur reprochaient, cherchaient-ils à masquer leurs insuccès constamment répétés par l'usage d'un langage inintelligible aux profanes, et abuser ainsi de la crédulité du vulgaire ?

A ces questions, il ne nous est point permis, vu l'obscurité du sujet, de fournir une réponse assurée. L'attitude la plus sage sur ce point nous est indiquée par le grand savant BOERHAVE, dont l'esprit averti et bienveillant semble très respectueux des ouvrages des alchimistes (2).

(1) Titre de l'ouvrage de GASTON DE CLAVES, 1594.

(2) BOERHAVE, *Eléments de chimie*. Leyde, 1732. Cités d'après l'édition française de 1754.

« Quand je comprends leur pensée, dit-il, je vois qu'ils décrivent très naturellement la pure vérité, qu'ils ne me trompent point et qu'ils ne se trompent pas eux-mêmes. Quand donc je parviens à des endroits où je n'entends pas ce qu'ils veulent dire, pourquoi les accuserais-je d'être dans l'erreur ?... » (1) Pour expliquer cependant que les secrets des philosophes hermétiques sont si éloignés des vérifications expérimentales que quand on suit leurs recettes on n'aboutit qu'à des déceptions, BOERHAVE risque une hypothèse qui, à la réflexion, semble plausible : les récits que des alchimistes nous livrent de leurs travaux sont les conséquences encore invérifiées de leurs théories scientifiques ; il ne s'agit pas de travaux actuellement réalisés, mais de projets de travaux, et les résultats indiqués sont les prolongements de leurs doctrines, non le fruit d'une constatation faite dans un laboratoire.

« Quand je lis les secrets de ces excellents artistes, qui connaissent « si bien les ouvrages de la Nature, il m'arrive de soupçonner qu'après « que de justes observations leur ont fait faire des découvertes très « singulières, prompts à en prévoir les suites, ils nous ont raconté « comme faites, des choses qui n'existaient encore que dans leur imagination, mais qu'ils concluaient qu'on pouvait faire, ou qu'ils « auraient sûrement faites s'ils avaient poussé leurs opérations plus « loin. » (2) Quand on pense aux difficultés de toutes sortes que les sciences expérimentales naissantes ont eu à subir, la supposition ci-dessus semble très vraisemblable.

Essayons maintenant, malgré les difficultés presque insurmontables de cet obscur sujet, de nous rendre compte de la place que tenait la pierre philosophale dans la technique alchimiste ; tout à l'heure, pour justifier leurs recherches, les philosophes hermétiques nous avaient dit que l'or est un métal parvenu au dernier terme de sa perfection. Les métaux imparfaits, comme des fruits verts exposés au soleil, se mûrissent spontanément et se transforment naturellement en or ; nous croyons donc que l'art spagyrique va nous apprendre à forcer la Nature ou tout au moins à concentrer l'action des forces naturelles sur le métal que nous voulons mûrir ; il n'en est pas ainsi ; et nos savants invoqueront maintenant, pour justifier leur méthode, une autre analogie entre les métaux et les êtres vivants, analogie que nous n'avions pas encore aperçue.

L'or, disent-ils, est bien un métal parfait ; mais il ne possède habi-

(1) BOERHAVE, vol. I, p. 256.

(2) BOERHAVE, vol. I, p. 257.

tuellement aucun excès de perfection et, par suite, il n'a aucune tendance à communiquer sa perfection aux métaux imparfaits avec lesquels il est en contact; en d'autres termes, il ne jouit d'aucune faculté d'assimilation; semblable à un corps mort (1), il a besoin pour digérer ses aliments, les transformer en sa substance propre, d'un ferment qui lui donnerait des propriétés des êtres vivants; c'est ce ferment dont une petite quantité seule est nécessaire pour fabriquer de grandes quantités d'or que nos savants nomment « pierre philosophale », ou « poudre de projection, etc... ». L'or, rendu vivant par l'action de la pierre, peut disparaître en un moment; mais en fin de compte, il s'accroît en quantité et nous le retrouvons semblable à lui-même. « Ne voyons-nous pas, dit SALOMON (2), qu'un seul grain de blé, mis en terre, produit plusieurs autres grains de même nature et que chacun de ces grains, mis en terre, produit tout de même plusieurs autres grains semblables, et cette multiplication se fait incessamment et plus ou moins selon que la terre se trouve mieux ou plus mal préparée? Il est vrai que ce grain, pour en produire plusieurs autres, se détruit; mais il est vrai aussi que c'est moins une destruction qui lui arrive qu'une multiplication et une régénération... Il en est de même de la multiplication de l'or par le moyen de la pierre philosophale et d'aliments convenablement choisis. »

Les philosophes hermétiques qui essaient de réaliser le grand œuvre doivent avoir à leur disposition (3) tout d'abord de la semence d'or; cette substance, ils la trouveront dans l'or même; mais dans l'or naturel, elle est comme morte; pour la vivifier, l'action de la pierre philosophale est nécessaire. Un grain de cette semence ainsi fécondée et tombant sur des métaux imparfaits qui sont l'aliment naturel de l'or, fermentera et se multipliera aux dépens de sa nourriture.

Qu'est-ce que la pierre philosophale? A cette question embarrassante, les alchimistes, qui n'ont jamais pu la réaliser, nous donnent des réponses extraordinairement variées; ils l'extraient indifféremment des minéraux, des plantes, des animaux, même de l'urine ou des excréments. Nous ne pouvons songer à les suivre; chacun d'eux, en effet, cherchait désespérément à mettre d'accord la réalité rebelle avec son espoir raisonné.

(1) HENSIG, *Dissertation sur la pierre philosophale*. Mémoire écrit vers 1680 et publié en français par ELDON, p. 121.

(2) SALOMON, p. XXXIX.

(3) HENSIG, p. 124.

La semence de l'or — et là-dessus la plupart des adeptes sont d'accord — la semence de l'or est contenue dans l'or même et il ne faut pas la chercher ailleurs; toute génération et augmentation d'une espèce, nous disent-ils, se fait par une espèce semblable; un lion engendre un lion et non un éléphant, etc...; c'est donc l'or même qui sera susceptible d'engendrer l'or. Chaque semence d'ailleurs ne se développe que dans un terrain favorable à son éclosion, là où elle trouve sa nourriture. Le laboureur sait cela et il ne sèmerait jamais du blé sur du marbre. L'aliment qui nourrit la semence ne lui donne aucune qualité particulière, mais il en reçoit d'elle; cet aliment doit contenir en lui-même les principes matériels dont la semence est composée. Un être ne se nourrit pas à volonté de n'importe quelle substance; nous le voyons chez les animaux et les plantes; l'aliment naturel de l'or, nous dit-on, c'est le métal imparfait. Enfin, les semences du règne animal et végétal ne donnent en aucun cas les fruits d'un autre : l'avoine ne produit jamais un lapin, ni la semence du renard un poirier! Il en est de même du germe de l'or qui est absolument spécifique; s'il se développe, il ne produira jamais que de l'or (1).

* * *

Remarquez maintenant comme la théorie hermétique a insensiblement dévié! Tout à l'heure, quand il s'agissait de nous convaincre de la possibilité de leur art en même temps que de son excellence, les alchimistes déclaraient que les métaux étaient des échantillons différents du même être parvenus à des stades différents de développement. Quand ils ont voulu nous expliquer comment la transmutation des métaux imparfaits en or se réaliserait dans les laboratoires, ils nous ont dit que, grâce à l'addition d'un ferment, l'or devenait substance vivante, douée par conséquent de la faculté d'assimilation et susceptible de transformer les métaux imparfaits dont elle se nourrit en sa substance propre. Ils insistaient sur le fait que l'or, semblable aux espèces vivantes, animaux ou plantes, les lions ou les avoines, par exemple, était possesseur de germes qui, dans les conditions favorables à leur développement, reproduisaient de l'or et uniquement de l'or.

Sans essayer de relier ce nouveau point de vue avec leur théorème fondamental: « les métaux sont les divers représentants d'une même

(1) HENSIG, p. 130.

L'Évolution du règne métallique d'après les Alchimistes du XVII^e siècle

Nous allons, dans les pages suivantes, tenter de donner une idée de la place que tenait la philosophie des métaux dans la théorie chimique au cours du XVII^e siècle. Il ne s'agit pas, bien entendu, d'entraîner le lecteur dans le labyrinthe mystérieux où les chercheurs de la pierre philosophale, charmés sans doute par la grandeur impressionnante de leur rêve, venaient se perdre ! Nous ne discuterons pas un instant avec les illuminés qui croyaient facilement réaliser le Grand Œuvre ; mais nous essayerons d'entrevoir quels motifs irrésistibles les portaient, malgré de nombreuses déceptions, à s'obstiner à résoudre cet insoluble problème : la transmutation des métaux imparfaits en or incorruptible ! Les adeptes, par une illusion invincible et sans cesse renaissante, se croyaient perpétuellement à la veille d'atteindre le but tant désiré qui leur échappait constamment et paraissait toujours à leur portée ; ils persistaient malgré les échecs répétés, les ruines, les moqueries et les ennuis innombrables, à courir après cette chimère. Certes, l'amour-propre qui croit pouvoir lever tous les obstacles, l'ambition d'être plus savant ou plus riche que les autres, le désir de faire partie d'une secte peu nombreuse et admirée, l'attrait du mystère et du romanesque, le goût des aventures et de la spéculation, quelques espoirs vagues et indéterminés, la charlatanerie et la superstition, bref toutes ces passions qui sans cesse agitent les hommes ont sans doute contribué à affermir un grand nombre de vocations et peut-être en ont-elles provoqué quelques-unes ; mais enfin ces obscures tendances qui ont joué un si grand rôle dans l'histoire des actions humaines ne sauraient, quelle que soit leur force, expliquer à elles seules la persistance d'un effort continu vers une découverte sensationnelle sur laquelle les savants, malgré leur consciencieux travail, venaient toujours achopper ! Les passions n'agiraient pas longtemps dans le même sens si elles ne rencontraient quelque complice dans l'esprit de ceux qui se laissent

séduire par elles; les espoirs tenaces des alchimistes trouvaient une alliée bien autorisée dans la théorie scientifique, œuvre de l'intelligence humaine. Ils étaient pour ainsi dire appelés par cette théorie et leur disparition, nous le verrons, coïncida avec sa ruine.

* * *

Que les métaux forment une classe naturelle de corps, ayant plus d'analogie entre eux qu'avec tous les autres corps connus, c'est ce qui apparaît clairement à nos sens, sans qu'il soit utile de justifier par des arguments cette impression toute physique. Que ces analogies aient une signification profonde, dépassant infiniment cette première vision expérimentale, c'est une chose sur laquelle les chimistes se sont accordés, sans discussion, bien qu'ils n'aient su se mettre d'accord sur la véritable cause de ces analogies! Pour comprendre donc la pression irrésistible que la vue de ces substances semblables et remarquables a produite pendant longtemps sur l'esprit humain, il nous faudra rechercher quelle valeur les savants du ^{xvii}^e siècle donnaient aux classifications. Et d'abord, il nous faudra rappeler les antiques croyances astrologiques, nées à une époque où l'astronomie était la seule science réellement constituée et où toutes les particularités du monde subliminaire se modélaient sur les mouvements apparents des astres, croyance dont l'influence atténuée a persisté jusqu'alors. Les anciens donc, et PARACELSE après eux, frappés par l'éclat et la pesanteur des corps métalliques, ont essayé d'établir entre les sept métaux qu'ils avaient isolés : l'or, l'argent, le vif-argent, le cuivre, le fer, l'étain, le plomb, et les sept astres errants : le soleil, la lune, Mercure, Vénus, Mars, Jupiter et Saturne, une correspondance harmonique. A chaque corps d'une de ces catégories correspondait un corps de l'autre catégorie. Sans qu'il y eût liaison directe entre les métaux et les planètes, on pouvait résumer par un même signe les propriétés des uns et des autres. Mais là ne s'arrêtait pas la science. Entre les astres errants, par exemple, et les différentes parties du corps humain régnait, d'après les médecins, une harmonie analogue... d'où cette théorie de la guérison qui semble assez bien construite quand on en possède la clef : que pour chaque maladie de l'homme, chaque désharmonie accidentelle d'un organe, le remède approprié se trouve être le métal en rapport avec la planète qui correspond à l'organe souffrant. Nous n'entrons pas plus avant dans l'examen de cette théorie qui paraît aujourd'hui si étrange, mais qui cependant a joué un rôle prépondérant dans

espèce d'êtres », sans s'autoriser de lui, les alchimistes tentèrent de répondre à ceux qui niaient la possibilité de la transmutation des métaux en se basant sur ce fait que chacun d'eux a une forme spécifique définie. Ils ne discutèrent pas sur ce point l'opinion de leurs adversaires et acceptèrent de porter le combat sur le terrain choisi par leurs ennemis... Les philosophes hermétiques déclarèrent donc simplement que les espèces ne sont pas fixes, et qu'elles varient constamment chez les animaux et les végétaux ; que ni la raison, ni l'expérience ne fournissent d'arguments en faveur de leur constance. « Nous voyons, dit ETTMULLER, les végétaux se changer les uns dans les autres, le froment en avoine, le seigle en ivraie, le cresson en menthe, parce qu'ils conviennent en leur racine et en leurs principes matériels. Pourquoi la même chose n'arriverait-elle pas aux métaux ? » (1) Alors que les alchimistes ne supposaient aucunement que l'espèce vivante, susceptible de varier, eût quelque tendance à réaliser un progrès et qu'ils la laissaient se modifier à la dérive, ils admirent, en vertu de leur principe primordial, que l'évolution des métaux se poursuit dans un sens déterminé et posé d'avance. Certes, les deux affirmations suivantes — les métaux dans certaines circonstances sont susceptibles d'être modifiés et — les métaux tendent à leur perfection — ne sont pas contradictoires entre elles ; seulement, elles n'apparaissent aucunement comme des suites logiques l'une de l'autre et, en l'absence de la dernière, la première n'apporte aucun argument en faveur de l'art spagyrique, qu'elle se contente de ne point proclamer absurde.

Les alchimistes, nous venons de le voir, pour justifier à la fois leur doctrine et leurs recherches, comparèrent constamment le règne métallique et le règne organisé dont ils supposèrent implicitement l'analogie. Que la transmutation des métaux soit semblable au développement du fruit, à la nutrition ou à la reproduction de l'être vivant, à l'évolution des espèces animales ou végétales, elle a toujours les caractères mêmes de la vie. Là, nous trouverons l'unité de la conception hermétique dont les détails nous ont semblé discordants ou inconciliables... Toutefois, sur ce dernier point, n'avons-nous pas été trop sévère ? Et ne voyons-nous pas, de nos jours, les biologistes considérer comme semblables l'évolution de l'individu, l'évolution de l'espèce, la nutrition et la reproduction ? L'esprit humain, par une tendance invincible, qui correspond peut-être aux lois de la Nature, passe constam-

(1) ETTMULLER, p. 442.

ment, et parfois inconsciemment, d'une conception à l'autre, ne pouvant jamais s'arrêter à la classification nominaliste qui lui a été suggérée par l'expérience. En fait, les diverses analogies entre les métaux et les êtres vivants que nous avons signalées et nettement séparées les unes des autres se trouvent dans de nombreux ouvrages indissolublement mêlées, ce qui jette quelque trouble dans l'ensemble de la théorie; les alchimistes les mélangeaient encore avec des hypothèses sur la composition chimique des métaux dont il nous faut dire quelques mots.

* * *

Demandons donc aux savants s'ils veulent bien nous faire connaître la composition des métaux. A cette question, une enquête approfondie fournirait un grand nombre de réponses; le même auteur tentera parfois d'atteindre ce difficile problème par plusieurs voies différentes et nous fournira des solutions qui ne l'aurent pas complètement satisfait et seront inconciliables entre elles. Ces solutions, il nous sera loisible de les classer dans les moules imposés par la tradition. Les analogies présumées des êtres vivants et des métaux avaient permis aux alchimistes de deviner quelle serait l'évolution normale du règne métallique; elles ne nous renseignaient aucunement sur les substances contenues actuellement dans les corps métalliques étudiés.

Nous devons tout d'abord observer qu'un grand nombre de savants, sans songer à faire des métaux une classe bien différenciée, relient leurs théories concernant ces remarquables substances à leur système général du monde; ou bien, ils considèrent les métaux comme des corps simples créés dès l'origine, ainsi que beaucoup d'autres corps, pour demeurer tels qu'ils sont, sans modification aucune; ou ils prétendent que chaque métal, comme chaque corps naturel, est dû à la modification de la matière première universelle; ou ils pensent que les métaux sont dus à la mixtion dans certaines circonstances des quatre éléments péripatéticiens ou à celle des trois principes spagyriques, etc., etc... (1).

Ces hypothèses sur la formation et la composition des métaux, à l'exception de la première qui proclamait l'éternité indestructible de chacun d'eux, s'accordent sur ce point qu'ils ne sont pas absolument fixes, et par conséquent ne déclarent pas logiquement irréalisable leur transmutation en or. Toutefois, si la recherche du Grand Œuvre

(1) BARBA discute toutes ces hypothèses.

chimie moderne; il ne peut y avoir, à proprement parler, de transmutation, mais seulement des substitutions. La théorie alchimique du perfectionnement naturel suggérait en se précisant des hypothèses explicatives qui ruinaient son principe fondamental; elle s'effondra sous le poids de ses propres excroissances; et, à l'époque de BOERHAVE (1) déjà, elle n'était plus que spéculativement discutée par des esprits distingués n'ayant jamais pu réaliser expérimentalement les rêves hermétiques et, d'autre part, ne subissant pas le prestige de la doctrine qui prévoyait l'évolution du règne métallique.

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* * *

La doctrine hermétique n'avait jamais réuni les suffrages unanimes des savants. Même à l'époque de son triomphe, il y eut toujours des sceptiques, et leur nombre s'accrut peu à peu; dans le courant du XVII^e siècle, beaucoup de chimistes, sans le renier en principe, ne cherchent plus à réaliser le Grand Œuvre; ni les échecs répétés des adeptes, ni les critiques d'isolés n'auraient été suffisants cependant pour renverser la doctrine; pour parvenir à ce résultat, il fallait une modification profonde dans la conception même que les chimistes se faisaient du monde matériel.

Il fallait tout d'abord qu'une autre notion de la perfection succédât au mysticisme des alchimistes; or, à l'époque du triomphe de la philosophie cartésienne, les savants se refusèrent à admettre qu'une substance quelconque qui occupe de l'étendue, soit théoriquement plus parfaite que toutes les substances analogues — les métaux ont été créés pour demeurer ce qu'ils sont; et le monde entier reste constamment semblable à lui-même, semblable à ce qu'il était au moment de la création; si, comme le prétend DESCARTES, « toutes les variétés qui » sont dans la matière dépendent du mouvement de ces parties », si, d'autre part, « Dieu, qui est la première cause du mouvement, en » conserve toujours une égale quantité dans l'univers » (2), la Nature, qui est parfaite, n'a donc aucune tendance au perfectionnement! L'idée même du perfectionnement paraîtra fantaisiste et inintelligible: d'une manière plus utilitaire et pratique, un certain nombre d'observateurs font remarquer que le fer, par exemple, avec lequel on construit des outils, rend plus de services à l'homme que l'or, dont la

(1) Voir sa *Chimie*.

(2) DESCARTES, « les Principes », titres de paragraphes.

grande valeur provient de conventions sociales, puisque, par une étrange aberration de notre raison, nous avons fait de cet inutile métal le signe, l'emblème et l'organe de la richesse. Ne serait-ce pas une conséquence du péché originel que cette substance soit convoitée par tant de gens, et l'art hermétique ne nous prouve-t-il pas l'incurable avarice et l'ambition dominante des adeptes qui veulent être riches? Ceux qui raisonnaient ainsi, ceux qui ne voyaient dans l'art de l'alchimiste qu'un problème de technique, qu'un hasard extraordinaire pourrait résoudre favorablement, ceux qui ne voyaient dans la « philosophie naturelle des métaux » qu'une fantaisie bizarre née sans motif scientifique dans l'esprit de quelque illuminé et répandue par une contagion étrange chez un très grand nombre de gens avides de devenir fortunés et puissants, ceux qui prenaient plaisir à souligner les incohérences et les contradictions des alchimistes, ne découvraient pas au milieu du fatras de leurs paroles la tendance au perfectionnement et à la stabilisation de la matière qui est le dogme fondamental de la théorie hermétique (1). Si, en effet, il nous est difficile, sinon impossible, de présenter un tableau harmonieux des opinions de nos prédécesseurs, nous remarquerons pourtant que ces opinions, prises séparément, s'accordaient sans illogisme avec le principe qui nous a semblé primordial. Il est juste d'ajouter que la plupart d'entre elles ne lui apportaient aucun appui et qu'elles semblaient souvent s'exclure l'une l'autre. Si nous entendons par doctrine une construction de notre esprit dans laquelle toutes les parties s'accordent pour former un tout homogène et dont il nous est loisible de contempler l'architecture, nous serons forcé de déclarer qu'au xvii^e siècle il n'y avait pas de doctrine alchimique. Mais là ne résidait pas la force de la philosophie hermétique contenue tout entière dans l'aspiration à la perfection tant désirée à la fois par la Nature et par l'esprit humain.

Nous n'avons pas prétendu épuiser en quelques pages les problèmes fort intéressants soulevés au xvii^e siècle par les progrès, puis par le déclin de la « philosophie naturelle des métaux ».

Aujourd'hui, elle ne nous semble plus qu'une curiosité historique. Faut-il dire que nos ancêtres, en s'obstinant à découvrir une transmutation irréalisable par les moyens dont nous disposons ont fait un travail inutile, que leurs efforts furent stériles et leur grand labeur vain? Une telle conclusion ne serait-elle pas superficielle et injuste?

(1) Voir *Examen des principes des alchimistes*, Paris, 1711, et certains ouvrages des chimistes atomistes ou cartésiens.

Ne pourrait-on découvrir entre la « forme » de leurs théories et certaines théories modernes qui, se basant sur le principe de CARNOT, proclament que le monde a une tendance à la stabilisation, certaines analogies profondes? Et un grand nombre de chimistes n'attribuent-ils pas à des résistances ou à des frottements la persistance des corps matériels dans un état physique qui, théoriquement, semble instable? L'esprit des alchimistes aurait-il préparé les cadres dans lesquels la pensée contemporaine a tenté de faire rentrer les phénomènes de la Nature?

A cette grave question qui pourrait susciter la curiosité des philosophes, l'historien n'a rien à répondre. Il serait heureux si quelque esprit spéculatif pouvait trouver dans ses travaux quelques-uns des éléments de la solution de cet important problème.

(*Paris.*)

HÉLÈNE METZGER.

On the History of Caloric

The play of ideas in human minds searching for truth is ever an interesting spectacle. Here a new thought flashes upon the intellect, there a new interpretation of our universe suggests itself. Thought clashes against thought. New hypotheses dispel the old. The intellectual panorama of successive theories of nature is most magnificent to behold.

In this article a few efforts of the human mind to secure a philosophical insight into some of the most common phenomena of nature will be discussed. Three topics will be considered : (I) the place of Lucretius in material theories of heat; (II) the interrelation of phlogiston and caloric; (III) the views on heat held by early American scientists.

Histories of science refer to different views on the nature of heat set forth by the Greek philosophers HERACLITUS, PARMENIDES, EMPEDOCLES and ARISTOTLE, but make no reference to the interesting views found in the *De rerum natura* of the Roman philosophical poet LUCRETIVS. Like HERACLITUS, LUCRETIVS believed in the existence of a material substance called « heat » and another material substance called « cold ». Thus LUCRETIVS says (1) : « Smells too incessantly stream from certain things; as does cold from rivers, heat from the sun, spray from the waves of the sea. » LUCRETIVS refers to the interaction between heat and air as follows : « Heat draws air along with it; there being no heat which has not air too mixed with it; for since its nature is rare, many first-beginnings of air must move about through it ».(2) Lightning and fire are materials of different degrees of fineness : « You may say that the heavenly fire of lightning subtle as it is formed of smaller shapes and therefore passes through openings which this our fire cannot pass born as it is of woods and sprung from pine ».(3)

(1) LUCRETIVS, *De rerum natura*, Bk. IV, line 223; also Bk. VI, line 925.

(2) *Loc. cit.*, Bk. III, line 235.

(3) *Loc. cit.*, Bk. II, lines 387-392

In celestial physics LUCRETIVS teaches : « that heat which the sun emits and that bright light pass not through empty void, and therefore they are forced to travel more slowly, until they cleave through the waves so to speak of air. Nor do the several minute bodies of heat pass on one by one, but closely entangled and massed together; where by at one and the same time they are pulled back by one another and are impeded from without, so that they are forced to travel more slowly. » (1)

LUCRETIVS touched upon a topic which greatly agitated chemists and physicists of the XVIIIth century, the question whether this heat substance has weight. He says (2) : « Now methinks is the place, herein to prove this point also that no bodily thing can by its own power be borne upwards and travel upwards; that the bodies of flames may not in this matter lead you into error. For they are begotten with an upward tendency, and in the same direction receive increase, and goodly crops and trees grow upwards, though their weights, so far as in them is, all tend downwards. And when the fires leap to the roofs of houses and with swift flame lick up rafters and beams, we are not to suppose that they do so spontaneously without a force pushing them up. » It follows from this that LUCRETIVS believed heat to be a substance possessing weight; heat was ponderable. Thus we see that this Roman poet who has been credited with a pre-vision of many modern theories believed in the material character of heat and cold.

We pass to our second topic, the historic relation of caloric to phlogiston. It has been stated in a prominent American publication that the caloric theory is an eighteenth century offspring of the phlogiston theory, that phlogiston « before it quitted the world », retarded the progress of physics « by generating an offspring especially inimical to the true ideas about radiant heat », called « caloric ». (3).

As a matter of fact, the actual historic sequence makes phlogiston follow in the wake of caloric theories. That heat was a material substance, had been held by philosophers of antiquity and also by the alchemists and scientists of the sixteenth century. Some European medieval writers divided the chemical elements into light and

(1) *Loc. cit.*, Bk. II, lines 150-156.

(2) *Loc. cit.*, II, lines 156 ff.

(3) S. P. LANGLEY, in *Proceedings Am. Association Advanc. Science* for 1888, vol. XXXVII, p. 7. Salem 1889.

heavy. As light they designated fire and air, fire being regarded absolutely light, air only relatively light. (1)

The empirical period of the seventeenth century brought with it a new conception, according to which heat was a motion or vibration of some sort. This view was held by FRANCIS BACON, RENÉ DESCARTES, JOHN LOCKE, ROBERT HOOKE, CHRISTIAN HUYGENS, ISAAC NEWTON, and others. Nevertheless, at this time, the old view was far from being abandoned generally. That heat is a substance was adhered to at the close of the sixteenth and in the seventeenth centuries by WILLIAM GILBERT, PIERRE GASSENDI, ROBERT BOYLE and SEBASTIAN BASSO. H. CARDAN, TELESIO (1565) and GILBERT followed the course of medieval writers in assuming this heat-substance to be imponderable (without weight).

About 1700 we behold the creation of the phlogiston doctrine by JOHANN J. BECHER and GEORG ERNST STAHL. BECHER replaces the four elements (earth, water, air and fire) of EMPEDOCLES by the three elements (earths), the « mercurial », « vitrifiable », and « combustible ». The combustible, called *terra pinguis*, escapes from bodies when they burn and from metals when they are calcined or oxidized. STAHL called this substance *phlogiston*.

In some ways, phlogiston trespassed upon the territory previously occupied by the older heat-substance; in part it occupied new territory. The exact relation of these two substances to each other was not clearly explained by STAHL and his followers.

The ancients looked upon ordinary combustion as a separation of the material of fire from the burning substance; PLINY regarded the ease with which sulphur burns as a proof of its being largely composed of the material of fire. Believers in the phlogiston theory considered combustion as a process of decomposition during which phlogiston escapes and the other constituent of the substance remains behind. Thus in ordinary combustion, phlogiston now took the place of the substance of fire.

Burning and the appearance of fire is according to STAHL only a special condition of the escaping phlogiston during which its smallest parts are in rapid upward motion designated by him *motus verticillaris*. (2) Phlogiston is not the material fire but the means for the

(1) H. KOPP, *Geschichte der Chemie*, 2. Theil, p. 271. Braunschweig, 1844.

(2) H. KOPP, *Geschichte der Chemie*, Dritter Theil, p. 138, 1845.

formation of flames of fire; that is, when phlogiston escapes, it does so in the form fire.

The daily fluctuations of temperature were not explained by the aid of phlogiston. Here the heat-substance was without a rival. But the two theories were in sharp conflict with each other in explaining the oxidation of metals — « calcination » as the process was called. This process, leading to an increase in weight, had been explained by the aid of a ponderable heat-substance as a *synthetic* process; the greater weight was due to heat material penetrating the metal. STAHL, on the other hand, explained this phenomenon as a process of *decomposition*; phlogiston was driven out of the metal regarded as a compound, leaving behind the more primitive earths. On the question of the increase in weight during oxidation, STAHL remained silent. Says KOPP (1) : « Probably STAHL hesitated to accept the explanation of BECHER, BOYLE and N. LEMERY which assumed explicitly a ponderable material fire, for he perceived that absorption of fire cannot be harmonized with his hypothesis of the phlogiston in the form of fire ». STAHL did not explain how a metal could lose phlogiston and at the same time gain weight. Apparently this greater weight was regarded as incidental. The Frenchman LEMERY (1675) made combustion of metals a double phenomenon in which phlogiston escapes from the burning metal and a ponderable fire material simultaneously unites with that metal. (2)

The result is greater weight. JEAN REY in France and JOHN MAYOW in England suggested the effect as resulting from an absorption of air, but this happy guess remained unheeded at that time.(3) BOERHAAVE made the pertinent observation that weighing the same piece of metal when hot and when cold disclosed no change in weight. Hence the increase in weight could not be due to the entry of a ponderable heat-substance. He and URBAN HIAERNE (1712) suggested the entry of some foreign substance from the coal or wood or the containing vessel, but did not test their suggestions experimentally. Still others advanced the notion that phlogiston possessed negative weight. GUYTON DE MORVEAU (1772) assumed simply that phlogiston is lighter than air, that therefore its escape from the metal results in greater

(1) H. KOPP, *Geschichte der Chemie*, Dritter Theil, p. 127, 1845.

(2) H. KOPP, *Loc. cit.*, Dritter Theil, p. 123, where quotations from the original sources are given.

(3) H. KOPP, *Loc. cit.*, Dritter Theil, p. 140.

weight of the parts left behind — thus confounding specific and absolute gravity. All these explanations, except LEMERY's are conducted without the aid of a ponderable heat-substance. None of them was generally accepted. The increase in weight of metallic calx remained a great paradox in the chemistry of the eighteenth century.

A few eighteenth century scientist took the view advocated the preceeding century by NEWTON, HUYGENS and others, that heat was due to vibratory motion. During the eighteenth century heat was a ponderable substance with the Swedish chemist KARL WILHELM SCHEELE, the Dutch physicist PIETER VAN MUSSCHENBROEK and others; it was an imponderable substance with JOHANN TOBIAS MAYER of Göttingen, HERMANN BOERHAAVE of Leyden and others. Evidently, extreme lack of unanimity prevailed on the nature of material heat and the rôle it played in the most common everyday phenomena of combustion. Hardly was there room in eighteenth century science for both phlogiston and material heat. Were we permitted to personify the two, then phlogiston would be represented as a big boy suggesting to the little boy caloric : « If one of us were to get out of here there would be more room for me. » For a while little caloric was down and out most the time. Later the big boy Phlogiston was killed by a giant and the little boy, Caloric, occupied the field alone, and himself grew big.

This giant was the French chemist LAVOISIER. He destroyed the phlogiston theory, but permitted the theory of material heat to remain. In his time the word « caloric » was coined. In 1787 four French chemists, LAVOISIER, DE MORVEAU, BERTHOLLET and DE FOURCROY began to revise and simplify chemical nomenclature. As a result, LAVOISIER, in his *Traité élémentaire de chimie*, 1789, used the word « calorique ». While stating that calorique need not be considered as really material, LAVOISIER nevertheless included « calorique », along with light, in his list of chemical elements. With phlogiston out of the way the doctrine of caloric became firmly established. The new school of chemists had found a satisfactory way of explaining the increase in weight of metals during oxidation; hence heat as a ponderable substance passed away and heat as an imponderable remained and flourished until the middle of the nineteenth century. It enjoyed this long life notwithstanding the ingenious experiments of Count RUMFORD and Sir HUMPHRY DAVY, which really disproved the caloric theory.

We pass to our third topic, the views on heat held by early Ame-

rican scientist. As Count RUMFORD's epoch-making experiments are so well known and as they were carried on abroad, we shall omit description of them. On November 16, 1770, before RUMFORD had begun his experiments, a physician, HUGH WILLIAMSON, read before the American Philosophical Society in Philadelphia a paper on comets containing also conjectures on the origin of heat (1).

He considers heat as a mode of motion. « Whatever produces a tremulous motion in the particles of any body, excites heat in that body, and *vice versa*... Does heat therefore consist in nothing else than the rapid vibrations of the minute particles of any body ? »

In a communication addressed to DAVID RITTENHOUSE and dated June 20, 1788, entitled « New and curious theory of Heat and Light » (2), BENJAMIN FRANKLIN uses language which is very strange, if one considers that it was written at a time when the corpuscular theory of light and the material theory of heat were at their height. Says FRANKLIN : « Universal space, as far as we know of it, seems to be filled with a subtle fluid, whose motion or vibration is called light. » He did not consider heat to be due to the motion of small particles or molecules as did WILLIAMSON but rather to be vibrations of the ether. How close FRANKLIN was to the more modern views on radiant energy is shown by the following passage : « This fluid may possibly be the same with that which being attracted by and entering into other more solid matter, dilates the substance by separating the constituent particles and so rendering some solids fluid, and maintaining the fluidity of others; ...as there may be a continuity or communication of this fluid through the air quite down to the earth, is it not by the vibrations given to it by the sun that light appears to us; and may it not be, that every one of the infinitely small vibrations, striking common matter with a certain force, enters its substance, is held there by attraction, and augmented by succeeding vibrations, till the matter has received as much as their force can drive into it ? Is it not thus that the surface of this globe is continually heated by such repeated vibrations in the day, and cooled by the escape of the heat when those vibrations are discontinued in the night or intercepted and reflected by clouds ? »

These and other passages that we might quote illustrate the truth of

(1) *Transactions Am. Philos. Society*, vol. I, p. 138. Philadelphia, 1789.

(2) *Transactions Am. Philos. Society*, vol. III, p. 5, 1793

the remark made by the Harvard professor JOHN WINTHROP, that FRANKLIN possessed extraordinary ability of starting big game for the natural philosophies to pursue and run down.

A few years later we find printed in the same Transactions a paper by the aged English chemist, JOSEPH PRIESTLEY, who spent the sunset years of his life in America. PRIESTLEY states on February 5, 1796 : « ...light and heat are almost universally allowed to be *substances*, though no person has been able to weigh them. »

More curious than convincing is a guess advanced by JAMES T. WATSON of New York on May 8, 1824 (1), relating to the heat produced by friction. « In rubbing two bodies together it is evident that the air in their pores, and interstices will be compressed, and as air readily yields heat by pressure, it is possible that the heat excited by friction may be thus explained. » Experiments on friction in the open and under the receiver of an air pump rendered partial support to this view. This explanation has the advantage of dispensing with a special heat substance; and it is really a mechanical or kinetic theory.

But the general sentiment among chemists and physicists crystallized in favor of the materialistic theory of heat. America's noted chemist, ROBERT HARE of Philadelphia, in 1822, gave his reasons (2) for rejecting the kinetic theory of RUMFORD and DAVY.

With the purpose of controverting the argument of DAVY he boldly entered upon the discussion of the mechanism of the motions of molecules in a body. According to the laws of (inelastic) impact he concluded that if equal weights of matter be mixed, the temperature ought to be the mean; and if equal bulks are mixed, the temperature ought to be as much nearer the previous temperature of the heavier substance as the weight of the latter is greater; but the opposite is in most instances true. This argument given at a time when not even the kinetic theory of gases had been worked out mathematically, marks an early attack of a problem which is not solved even at the present day. It was not difficult to criticize HARE's argument.

DENISON OLMSTED of Yale says (3) : « Little as I am disposed to

(1) B. SILLIMAN'S, *American Journal of Science and Arts*, vol. VIII, p. 276. New Haven, 1824.

(2) *American Journal of Science and Arts*, vol. IV, p. 142, 1819.

(3) *American Journal of Science and Arts*, vol. XI, p. 358, 1826.

adopt the views of Sir HUMPHRY DAVY, I cannot but think that Dr. HARE has here suggested an answer which is not altogether unobjectionable. The application of his rule or test makes it necessary to suppose that the particles subjected to impact are all moving in the same direction — that they all actually come into collision, each upon each and that they are non-elastic; none of which conditions are capable of being proved actually to exist. »

Moreover, « it by no means establishes the doctrine of the materiality of heat, to prove that DAVY has failed of showing that it is a product of motion. Both parties in my view, evince how idle it is to reason respecting chemical phenomena upon mechanical principles. » This attack directed by OLMSTED against the reasoning of chemists drew from HARE a rejoinder (1) in which he re-affirms his argument and challenges OLMSTED to explain DAVY's experiment « in which a thermometer in the focus of one mirror is influenced by a hot body in the focus of another mirror the whole being within an exhausted receiver, ...if the cause of it is not material. » OLMSTED replied that DAVY's mirror experiment simply shows that radiation is not dependent on the presence of air; it does not prove that heat is a material substance. He pointed out that DAVY's molecular motions were conceived to be both rotatory and vibratory, while HARE considered them simply rectilinear and in one continued direction. It must be noted that this controversy is not between representatives of two rival schools but is between men who are both adherents of the materialistic school. At this time the mechanical or kinetic theory of heat had few friends in America. OLMSTED said in 1826 (2): « A few maintain that we have sufficient reason to deny its materiality, while a greater number think that its materiality is capable of being established by proof. »

In 1830 BENJAMIN SILLIMAN (3) spoke of light, heat and galvanism as « imponderable agents », evidently hesitating to call heat a « substance ». This is substantially the position taken by the Swede chemist BERZELIUS who spoke of light, heat, electricity and magnetism as « properties of bodies » (4), yet used the term « imponderable ».

(1) *American Journal of Science and Arts*, vol. XII, p. 52. New Haven, 1827.

(2) *American Journal of Science and Arts*, vol. XI, p. 356, 1826.

(3) B. SILLIMAN, *Elements of Chemistry*, vol. I, p. 1. New Haven, 1830.

(4) J. J. BERZELIUS, *Lehrbuch der Chemie*, übers. v. WÖHLER, 3 te Ausgabe, p. 11. Dresden und Leipzig, 1833.

However, twenty-nine years later, in SILLIMAN'S *First Principles of Physics*, 1859, heat is said to be « due to the vibratory movements of the molecules ». The earlier view of it as an « imponderable agent » is found in other American texts. (1)

But there were books printed in America which did not hesitate to use the phrase « imponderable substance », even as late as 1856 and 1863. (2)

In Europe the widely used text on chemistry of the Heidelberg professor LEOPOLD GMELIN spoke of heat as an imponderable substance (3). J. S. T. GEHLER takes the same stand in 1844. (4). In 1862 JOHN TYNDALL (5) stated in a lecture delivered at the Royal Institution in London, « till very lately ... the material theory had the greater number of adherents, being opposed by only a few eminent men ». TYNDALL'S book was reviewed favorably in the *American Journal of Science and Arts*, Vol. 86, 1863, page 310.

One consideration which delayed the acceptance of the kinetic theory of heat was the confusion which prevailed between heat and radiant energy. The two were assumed to be the same, to the extent that an argument against the one was taken to be an argument against the other. We read in a work of 1829, « the strongest argument in favor of the material nature of heat is probably that which is derived from its radiation ». (6)

PICTET suspended in an exhausted receiver a thermometer and found it capable of changing its temperature. From this he concluded that heat was capable of passing through a vacuum, hence must be an imponderable substance.

Time has shown that caloric and phlogiston were false keys for unlocking the secrets of nature. Nevertheless they were better than

(1) For instance, ALONZO GRAY'S, *Elements of Chemistry*, 2nd Ed., p. 22 New York, 1841.

(2) See E. TURNER, *Elements of Chemistry*, American edition, p. 5. Philadelphia, 1840. — JOHN A. PORTER, *Principles of Chemistry*, p. 27. New York, 1856. — JOHN JOHNSTON, *Manual of Chemistry*, 6th Ed., p. 17. Philadelphia, 1863.

(3) L. GMELIN, *Handbuch der Theoretischen Chemie*, vol. I, 1827, and later editions.

(4) J. S. T. GEHLER, *Physikalisches Wörterbuch*, Bd. 10, « Wärme », 1841.

(5) J. TYNDALL, *Heat as a Mode of Motion*, p. 37, 1866.

(6) *Natural Philosophy*, Library of Useful Knowledge, p. 1, « Heat ». London, 1829.

no keys, for they fitted well enough to assist JOSEPH BLACK, JOSEPH PRIESTLEY, KARL W. SCHEELE and others to wrest from nature several of her guarded secrets. Our brief story again exemplifies the truth expressed in Locksley Hall :

Science moves, but slowly slowly,
Creeping on from point to point.

(University of California.)

FLORIAN CAJORI.

Notes and Correspondence

Cuvier et les Belles-Lettres. — JEAN DARCET, qui fut chimiste des manufactures de Sèvres et des Gobelins et membre de l'Institut, naquit à Douazit, près Saint-Sever (Landes) en 1725 et mourut en 1801. En dehors de ses nombreux travaux de chimie industrielle, il se recommande à nous par les notes dont il a enrichi le *Traité des Questions naturelles* de SÈNÈQUE, et aussi par le fait qu'il fut l'exécuteur testamentaire et dans une certaine mesure le collaborateur de MONTESQUIEU. J'extrais les paroles suivantes de l'éloge que CUVIER lui consacra en 1802. A une époque où d'aucuns s'efforcent d'industrialiser les recherches scientifiques, ces paroles méritent d'être répétées (1) :

« Je n'aurais pas parlé d'un avantage qui semble appartenir à toute éducation libérale, si on ne paraissait y donner trop peu d'attention dans celle d'aujourd'hui. Quelques jeunes gens, qui se livrent aux sciences avec succès, négligent, dit-on, les lettres; et cependant celles-ci sont un besoin pour les premières. Qu'on se rappelle l'histoire des hommes qui ont le plus étendu le domaine des sciences, et l'on verra bientôt qu'il est plus nécessaire qu'on ne croit, pour apprendre à bien raisonner, de se nourrir des ouvrages qui ne passent d'ordinaire que pour être bien écrits. En effet, les premiers élémens des sciences n'exercent peut-être pas assez la logique, précisément parce qu'ils sont trop évidens, et c'est en s'occupant des matières délicates de la morale et du goût qu'on acquiert cette finesse de tact qui conduit seule aux hautes découvertes. Comment d'ailleurs un homme capable de trouver des vérités nouvelles dédaignerait-il l'art de les imprimer dans l'esprit des autres par cette justesse d'expression, par cette vivacité d'images, charme des cœurs sensibles, et mérite éternel des ouvrages classiques? »

G. S

Collection Science et Civilisation. — Je signalais récemment (*Isis*, IV, 324) deux collections dues à l'initiative des éditeurs GAUTHIER-VILLARS ET C^{ie}, et dont l'une : *Les Maîtres de la Pensée scienti-*

(1) *Recueil des éloges historiques*, t. I, p. 172-173. Paris 1819.

fique, venait heureusement donner, sous une forme accessible, les œuvres classiques dont doit être nourrie la pensée du savant. Les volumes de cette collection se succèdent avec régularité, et aux mémoires déjà signalés sont venues s'ajouter des réimpressions de travaux d'AMPÈRE : *Mémoires sur l'électromagnétisme et l'électrodynamique*; de LAPLACE : *Essai philosophique sur les probabilités*; de BOUGUER : *Essai d'optique sur la graduation de la lumière*.

MAURICE SOLOVINE, qui dirige cette publication, assume en même temps la direction d'une nouvelle collection d'exposés synthétiques du savoir humain, dite *Science et Civilisation*, publiée par les mêmes éditeurs, et qui s'ouvre par une traduction, préfacée par LANGEVIN, des conférences de J. JOSEPH THOMSON sur *Electricité et matière*.

Cette collection se présente comme un organe de culture générale; elle se propose de faire connaître au public cultivé les résultats obtenus dans tous les domaines où s'exerce l'activité de l'esprit humain, aussi bien d'ailleurs dans l'étude des civilisations et des institutions du passé que dans les problèmes scientifiques et philosophiques actuels. Chaque question, déclare l'éditeur, sera traitée de façon non seulement à donner un tableau fidèle de l'état actuel des recherches, mais aussi à en dégager la signification philosophique. Nous avons déjà plusieurs collections de ce genre (ALCAN, FLAMMARION, PAYOT, etc.); le fait que celle-ci s'ouvre par la traduction d'un travail classique semble indiquer qu'elle est conçue dans un esprit plus large que ses devancières. Le petit livre de J.-J. THOMSON est présenté de façon très agréable, et fait dès l'abord voir sous un jour favorable les volumes qui suivront.

L. GUINET.

On the Prevalence of Inaccurate Criticism. — Accurate and generous criticism is the soul of progress. Superficial, inaccurate and careless criticism coming from high sources is deadening. As one looks into history, one finds that incorrect and harsh criticism directed against men of science has done much harm by reducing and checking scientific research. To be convinced of this one needs only recall the attacks made by ROBERVAL upon TORRICELLI in the study of the cycloid, by STEINER upon PLÜCKER in the use of analytic methods in geometry, by Lord BROUGHAM upon THOMAS YOUNG in relation to the wave-theory of light, and by the writers of COLLINS' *Commercium Epistolicum* upon LEIBNIZ in connection with the invention of the calculus.

There are as yet comparatively few men in the United States who conduct research in the history of mathematics. Nearly all our active mathematicians are engaged in advancing the science itself, rather than the history of it. For that reason it seems all the more impor-

tant that persons who assume the rôle of reviewers of historical works should exercise due care. A critic can be accurate and still find plenty of opportunity to exercise his art.

Inaccurate criticisms have appeared in leading journals published in the United States. Our aim in this article is to direct attention to the existence of inaccuracies, with the hope that such publicity will result in the raising of the standards of criticism. Particularly regrettable are unfair criticisms upon historians who are dead. The memories of them should not be encumbered with errors which they did not commit.

Since a critic can select his own point of attack, at pleasure, and can confine himself to topics on which he is best informed, errors on the part of a careful critic are practically eliminated. The present writer is indebted to reviewers for not a few corrections to his historical works. But in an astonishingly large number of cases he and other writers have been criticized when the reviewers themselves were in error. At times the carelessness of reviewers has been appalling. It is not my purpose to set forth here the data which establish my contention. Only by way of illustration do I cite two criticisms that appeared recently in this journal and are fresh in my mind, since they apply to myself. In my *History of Mathematics* 1919, p. 302, I say: "EUCLID proved (I, 27) that 'if a straight line falling on two other straight lines make the alternate angles equal to one another, the two straight lines shall be parallel to one another'. Being unable to prove that in every other case the two lines are not parallel, he *assumed* this to be true in what is now generally called the 5th 'axiom' ". A reviewer takes me to task in these words (1): "This postulate of EUCLID was not 'proved' by him, " the erroneous impression being left with the reader that I claimed that EUCLID 'proved' his parallel-postulate. Later the same reviewer subjects this same passage in my history to a wholly different criticism (2): "The natural impression conveyed by these two sentences is that EUCLID proved the theorem mentioned in the former sentence without making the assumption to which reference is made in the latter. Such an impression is incorrect and is the more unfortunate since it is related to a fundamental fact in the history of elementary geometry. " Here the reviewer is wrong again. EUCLID in I, 27 proves that the two lines are parallel when the alternate angles are *given equal*, by showing that, if the two lines did meet, the alternate angles would not be equal—a *reductio ad absurdum*. The reviewer erroneously claims that

(1) G. A. MILLER in *School Science and Mathematics* t. XIX, p. 834.

(2) G. A. MILLER in *Isis*, t. IV, 1921, p. 10.

EUCLID used in his proof of I. 27 the assumption to which I make reference in my second sentence, namely, the assumption that in all cases where the alternate angles are not equal, the two lines do meet. In other words, the reviewer puts forth the incorrect claim that EUCLID used the parallel-postulate, or its equivalent, in the proof of I, 27, and then blames me because I do not labor under that same misapprehension.

My second example relates to a misquotation from my *History*, 1919, p. 164; I am taken to task for what I did not say. Twice is it stated (1) that in describing FERMAT's process for finding maxima and minima I used the phrase "indeterminate quantity e ". As a matter of fact the word "indeterminate" does not occur in the passage referred to in my *History*. The term that I do use is a translation from FERMAT's Latin. This misquotation illustrates the extreme carelessness with which the review was prepared. My explanation of FERMAT's process is correct. My later sentence, cited by the reviewer, viz. "FERMAT introduced the conception of infinitely small differences between consecutive values of a function" is correct also, as the reviewer might have verified, had he taken the trouble to consult other parts of FERMAT, particularly his *Methods of Quadrature*.

Is it not desirable to enhance the accuracy of American criticism? Able, careful, and generous criticism inspires authors to higher endeavor. Careless and inaccurate criticism printed in our leading journals chills enthusiasm. Nor is it well that false criticism should cause the general reader to lose faith in the substantial accuracy of the modern histories of mathematics.

FLORIAN CAJORI.

The Newcomen Society for the Study of the History of Engineering and Technology. — The idea of forming a Society for the study of the historical side particularly of engineering arose during the WATT Centenary Commemoration at Birmingham in 1919. On that occasion a number of engineers, among whom were some who had been colleagues in JAMES WATT's old firm, foregathered and exchanged reminiscences of former times.

Several people felt that information of this character ought to be preserved, but probably no steps would have been taken in the matter had not ARTHUR TITLEY, *M. I. Mech. E.*, drawn up a memorandum outlining the constitution of such a Society, with a scope sufficiently wide to include the history of industrial processes generally. This

(1) *Isis*, t. IV, p. 11.

memorandum he put before friends of similar tastes to himself at a meeting which he called at his office on May 5th., 1920, when a small Committee was elected to carry the scheme into effect. Gentlemen in the London area were communicated with, and a meeting was held on June 4th at the office of *The Engineer*. Discussion took place as to the scope, aims and amount of subscription, and it was felt that as the Society was the first of its kind it should assume an International character. Definite support was forthcoming, and TITLEY was elected President, with a London Committee to act in collaboration with that at Birmingham.

A suitable short name for the Society was felt to be a desideratum, but nothing generally satisfactory was suggested at the meeting, so that the decision as to the name was relegated to the Committee.

This Committee met subsequently at the Savage Club, and after long discussion a titular name with a sub-title, by analogy with the HAKLUYT, the LINNAEAN, the FARADAY and other Societies was suggested. The name of THOMAS NEWCOMEN, to whom we owe the reciprocating steam engine, was chosen, not because the Society proposes to devote itself wholly or even mainly to the subject of NEWCOMEN and the steam engine, but as being symbolical of its aims. The name was felt to be appropriate, and it was subsequently agreed to by the Birmingham Committee.

The steam engine has been, perhaps, the most powerful agent in the material progress of mankind. Our mining industry, our iron manufacture, our factories of every description, the locomotive and the steamboat, have all grown up by the aid of the reciprocating engine. The fact that this engine is now being superseded in certain directions is not material — these other forms could scarcely have come into existence had not the reciprocating engine previously existed. The machine of NEWCOMEN has been improved upon and rendered more efficient by a host of inventors, at the head of whom stands JAMES WATT; but the essential features — the cylinder and piston — are NEWCOMEN'S.

A leaflet was drawn up setting forth in detail the objects of the Society and, as these have now been formally adopted at a Special General Meeting, it is desirable to state them. They are :

I. To disseminate historical information among its Members by meetings, intercourse, discussion, correspondence, circulation of notes and papers, and visits to objects and places of interest.

II. To act as a channel of communication between Members who are engaged on similar lines of research or study; to indicate as far as possible where information is to be found.

III. To collect and preserve or cause to be preserved, locally or na-

tionally, examples, records, MSS., drawings and illustrations of or relating to engineering work and industrial processes.

IV. To collect and preserve in a similar way biographical matter concerning those men who have contributed to engineering or industrial progress.

V. To publish from time to time a Volume containing original papers by Members, bibliographical notes and historical material not generally accessible.

VI. To form by collaboration among its Members a Card Index of published information on the historical aspect of engineering and technology.

VII. To do all such acts as shall lead to active corporate life of the Society.

Copies of this leaflet were sent to people likely to be interested, and the fact that such a Society was in existence was made known also through the Press, with such a response that it was found possible to hold the first General Meeting in London on November 5th, 1920. Appropriately enough, the subject of the first paper, contributed by E. WYNDHAM HULME, was « The Literature of Historical Engineering to the year 1640 ». This has been followed by papers on « The Rise and Fall of the Sussex Iron Manufacture », by RHYS JENKINS, and « The Mystery of TREVITHICK'S London Locomotives, » by LOUGHNAN ST. L. PENDRED. The Session closed with a Summer Meeting of two days at Birmingham, June 16th and 17th, when the President delivered his address, and A. SEYMOUR JONES, contributed a paper on « The Invention of Roller Drawing in Cotton Spinning. » Visits were paid to places of interest in Birmingham and Warwickshire.

The Society has now a membership of upwards of 100, including the historic names of SAVERY, NEWCOMEN and TREVITHICK. The Members are scattered over Great Britain with a sprinkling in the United States, and one or two in other countries. The Society is now being placed on a permanent basis, the place of the Committee being taken by a Council duly elected by the Members in General Meeting. Membership is open to persons of either sex of any nationality.

The Hon. Sec. of the Society, H. W. DICKINSON, will be glad to reply to communications addressed to him at The Science Museum, South Kensington, London, S. W. 7.

Reviews

P. Ver Eecke. — *Les Œuvres complètes d'Archimède*, traduites du grec en français, avec une introduction et des notes, LIX + 553 p. (275 × 190). Paris et Bruxelles, DESCLÉE, DE BROUWER et C^{ie}, 1921.

[75 fr.]

De plus en plus les savants vont se retremper aux sources fraîches de la science antique, aux grandes œuvres dont la lecture devrait jouer pour leur culture le rôle que jouent les HOMÈRE, les EURIPIDE, les PLATON, pour la culture des littérateurs, des philosophes. Je ne pense pas cependant que la lecture dans le texte grec ou latin offre des avantages sur celle d'une bonne traduction en langue vulgaire, et tandis qu'une édition du texte grec d'ARCHIMÈDE présente un intérêt philologique indiscutable, mais ne peut être lue que par un nombre relativement restreint d'initiés, une traduction sérieuse s'adresse à un public autrement étendu et a une portée culturelle beaucoup plus considérable.

La traduction que donne VER EECKE des *Œuvres complètes d'Archimède* comble enfin une lacune dans la librairie française. — Combien il en reste à combler et quel vaste champ demeure ouvert aux traducteurs ! — Nous n'avions, en effet, en français, qu'une traduction de l'*Équilibre des Plans* et des *Corps flottants*, avec des commentaires de PIERRE FORCADEL DE BÉZIERS, parue en deux opuscules imprimés à Paris en 1565, pour ainsi dire introuvables, et la traduction de PEYRARD, Paris, 1807, revue par DELAMBRE l'année suivante.

Cette dernière, basée sur l'édition gréco-latine incorrecte d'Oxford (1792), était manifestement insuffisante, quelles qu'aient pu être ses qualités, depuis l'étude critique des textes manuscrits d'ARCHIMÈDE faite par J.-L. HEIBERG en 1879-1880 et surtout depuis l'étude d'un manuscrit découvert en 1899 au monastère de S^t-Savas (Palestine) par PAPADOPOULOS KERAMEUS, et qui donnait le texte presque complet d'un traité inédit de la *Méthode mécanique*, la majeure partie du texte grec du traité des *Corps flottants*, dont on ne possédait qu'une version latine du XII^e siècle, refaite sur l'arabe, un fragment du *Stomachion*, et des parties assez considérables de plusieurs des traités connus : de la

Sphère, des Spirales, de la Mesure du Cercle et de l'Équilibre des Plans. Une traduction du *Traité de la Méthode* avait été donnée dès 1907 par TH. REINACH, avec une introduction de PAINLEVÉ dans la *Revue générale des Sciences pures et appliquées* (T. XVIII, p. 911-928 et 954-961).

La traduction de VER EECKE est complète; elle tient compte des travaux antérieurs et de tous ces éléments récents qui sont condensés dans la nouvelle édition, si parfaite, du texte grec accompagné d'une version latine, donnée par HEIBERG en 1913-1915.

Cette traduction serre, semble-t-il, le texte grec d'aussi près qu'il est possible et diffère sur un point important de la traduction anglaise de TH -L. HEATH (1897 et 1912) et de la traduction allemande de FR. KLEIN (1914). — VER EECKE semble ne pas connaître cette dernière. — Toutes les traductions d'ARCHIMÈDE antérieures à celle qui nous occupe ne sont pas, en effet, à proprement parler, des traductions, mais énoncent les propositions du géomètre grec dans le langage actuel et résument fortement les démonstrations en notations usuelles. La lecture d'un texte de ce genre est évidemment plus facile que celle du texte de VER EECKE, qui donne cependant, chaque fois qu'il est nécessaire, en des notes nombreuses et copieuses, une transposition plus explicite et en notations modernes. Mais une traduction d'un mathématicien de l'antiquité ne répond vraiment à son but, à mon sens, que si elle oblige le lecteur à pénétrer dans l'intimité profonde de l'auteur qu'il étudie, à le suivre dans sa pensée telle qu'il l'a lui-même exprimée, au milieu même des obscurités qu'elle peut parfois présenter. J'estime donc que VER EECKE a rendu un service considérable à la science en lui donnant un instrument de culture qui lui manquait. Il annonce une traduction d'APOLLONIUS DE PERGE; puisse-t-il la mener à bien en suivant les mêmes principes que ceux qui l'ont guidé pour ARCHIMÈDE.

L'ouvrage, d'une exécution typographique extrêmement soignée, est précédé d'une longue introduction sur la vie et l'œuvre d'ARCHIMÈDE.

Toutes réserves faites sur le prix extrêmement élevé du volume, je ne formulerai qu'une critique légère; elle a trait aux références bibliographiques: lorsque le traducteur donne indication d'un mémoire paru dans un recueil déterminé, mais qui fait en même temps partie d'une édition plus facilement accessible, il est regrettable qu'il s'en tienne à l'indication de la première collection: c'est le cas par exemple pour les travaux de P. TANNERY qui sont d'un accès plus facile dans le recueil de ses *Mémoires scientifiques*, publié par HEIBERG et ZEUTHEN, que dans les *Mémoires de la Société des Sciences de Bordeaux*.

L. GUINET.

Friedrich Dannemann. — *PLINIUS und seine Naturgeschichte in ihrer Bedeutung für die Gegenwart* (Klassiker der Naturwissenschaft & Technik, edited by Dr. FRANZ STRUNZ), 251 p. Jena, EUGEN DIEDERICH, 1921.

The purpose of this book is to give in German translation those parts of PLINY's Natural History which might be of educational value at the present time, and, by means of a survey of the interrelations of the different branches of knowledge in the Roman world of the first century A. D., to present to the modern reader a stage in the progress of scientific thought. The outcome of the labors of the translator and annotator is a readable, indeed delightful, volume, well within the comprehension of everyone with an inclination toward serious study. He deserves the gratitude of those who read German with facility and at the same time balk at the task offered by PLINY's volumes in Latin.

The book contains a brief general introduction, reviewing in a simple way the history of Greek, and, to some extent, of Roman, science, and emphasizing the part played in the development of learning by the writers to whom PLINY was especially indebted for the materials of the Natural History. This general introduction is followed by an essay on PLINY's life and works, as well as by four special introductions to the sections of annotated abstracts from the *Historia Naturalis*. These sections, which of course make up the bulk of the volume, (53-245), deal with Geography and Ethnology, Zoölogy, Botany, and Mineralogy.

On the whole very good judgment has been shown in the selection of passages for translation and comment. Readers of DANNEMANN's version will be deeply interested in the discussion of the sphericity of the earth (64), the sexuality of plants (141), and the nature of vision (221-222). The general reader may find the section on plants a little tedious in places. The footnotes are not very numerous, but they are marked at times by the repetitions and the insistence on the obvious that characterize classroom instruction the world over. DANNEMANN ventures the opinion that PLINY's comprehensive work is comparable with v. HUMBOLDT's *Kosmos* rather than with a modern encyclopedia. In translating *bitumen liquidum* by *Erdöl* (212) he seems to have given an interpretation which, though undoubtedly just, should have been reserved for a footnote.

FRIEDRICH DANNEMANN is best known by the first edition of his four-volume work *Die Naturwissenschaften in ihrer Entwicklung und im ihrem Zusammenhange* (ENGELMANN, Leipzig, 1910-1913), which is the most comprehensive history of science that has yet appeared; and, in the judgment of the writer of this review, it is the best, in spite of its

obvious omissions, its numerous errors, and prepossessions. (The second-revised-edition will be welcomed by a host of readers.) (1) Like it, the present brief work on PLINY, which is to be regarded as in some sense supplementary to the larger, disarms hostile criticism, because it attempts to do something that should be done. However, specialists in history will not save time by consulting DANNEMANN'S *Plinius*, and English readers-except those who are very familiar with German-will probably prefer BOSTOCK and RILEY'S six-volume translation of the *Natural History* to this book of excerpts in German, excellent though the latter is.

WALTER LIBBY.

H. Suter. — *Die astronomischen Tafeln des MUHAMMED IBN MŪSĀ AL-KHWĀRIZMĪ in der Bearbeitung des MASLAMA IBN AHMED AL-MADJRĪTĪ und der latein. Uebersetzung des ATHELHARD VON BATH auf Grund der Vorarbeiten von A. BJÖRNBO und R. BESTHORN herausgegeben und kommentiert.* (D. Kgl. Danske Vidensk. Selsk. Skrifter, 7. Raekke, Historisk og Filosofisk Afd. III, 1. xxxv + 255 S. Quart.) Köbenhavn, A. F. HÖST und SÖN, 1914.

Wenn diese Zeitschrift, in der Durchführung ihres umfassenden Programms durch eine Weltkatastrophe verhindert, die auch heute noch schwer auf den Völkern lastet, die zerrissenen Fäden wieder anknüpft und über die im letzten Jahrzehnt erschienenen wissenschaftsgeschichtlichen Werke berichtet, darf sie an einer Arbeit nicht vorübergehen, die als Musterbeispiel dafür gelten kann, wie ein überaus spröder Stoff — ein astronomisches Tabellenwerk — durch einen sorgfältig angelegten Kommentar aus der Sprache einer vergangenen Epoche in die der Gegenwart zu übertragen und für den modernen Leser fruchtbar zu machen ist. Drei berühmten Namen begegnen wir im Titel: dem Vater der arabischen Algebra, MUHAMMED IBN MŪSĀ AL-KHWĀRIZMĪ (gest. um 830/40), dem spanischen Astronomen MASLAMA IBN AHMED aus Madrid (gest. 1007/8) und dem Uebersetzer arabischer Werke ins Lateinische, ATHELHARD VON BATH (um 1130). Drei Forscher unserer Tage teilen sich in das Verdienst, die wissenschaftliche Urkunde ersten Ranges der Vergessenheit entrissen und der Geistesgeschichte wiedergeschenkt zu haben. Als BJÖRNBO 1911 starb, hatte er die Ausgabe des Textes und der Tafeln nach den Handschriften von Oxford, Chartres und Paris vorbereitet, auch hatte der Arabist BESTHORN bereits eine Uebersetzung der im lateinischen Text auftretenden arabischen Ausdrücke beigezeichnet; die Vergleichung einer vierten Hs. in Madrid, die Abfassung von Einleitung und Kom-

(1) *Isis*, t. VI, pp. 110, 563.

mentar und die Herausgabe des Ganzen ist das besondere Verdienst des Altmeisters der arabischen Mathematikgeschichte, H. SUTER's in Zürich. Wir müssen aber noch mehr Namen nennen, um die Aufzählung der an diesem Werke Beteiligten zu vervollständigen. Die Madrider Handschrift ist durch ROBERT VON CHESTER überarbeitet, ein anderer Engländer, ROGER VON HEREFORD, hat im zweiten Teil dieser Hs. ergänzende Tafeln beigelegt, auch scheint HERMANNUS DALMATA, der Zeitgenosse und Freund ROBERTS, die Tafeln nochmals übersetzt und die Oxforder Handschrift beeinflusst zu haben (Einf. S. xiii). Bei der mühevollen Bearbeitung des Kommentars und der Deutung arabisch-lateinischer Ausdrücke endlich bot die Ausgabe AL-BATTĀNĪS durch C. A. NALLINO und der Scharfsinn C. SEYBOIDS willkommene Hilfe.

Es kennzeichnet die Lage der wissenschaftlichen Astronomie — und man darf wohl hinzufügen, die der Wissenschaft überhaupt —, dass noch am Anfang des XI. Jahrhunderts Inder, Perser, Syrer, Griechen am Abbasidenhofe Träger der wissenschaftlichen Ueberlieferung und Praxis waren und der Perser MUHAMMED IBN MŪSĀ, wie IBN AL-QIFĪ in seiner Biographie AL-FAZĀRĪ's mitteilt, seine Tafeln nach indischen, persischen und griechischen Vorbildern bearbeitete; mehr noch, dass er die *persische Aera* Jazdagards, die mit dem 16. VI. 632 beginnt, den Tafeln zugrunde legte und erst MASLAMA die Umstellung auf die Jahre der Hġra vornahm. Nicht minder fesselnd ist die Beobachtung der Fortschritte in der Kunst der Uebersetzung arabischer Texte von ATHELHARD zu ROBERT VON CHESTER. Wo jener das Wort *alziġ*, d. i. das persische *ziġ* = Tafelwerk, unübersetzt lässt, fügt dieser die Uebersetzung bei *liber ezeig id est chanonum*; wo jener *elgeib* sagt, übersetzt ROBERT *sinus* — soweit mir bekannt, die älteste Stelle, an der dieser uns auch heute noch geläufige Ausdruck für die trigonometrische Funktion vorkommt.

Einem lateinischen Text von 31 Seiten steht ein Kommentar von mehr als doppeltem Umfang gegenüber. Die astronomischen Tafeln umfassen 122 Seiten, weitere 22 Seiten entfallen auf Nachträge, Glossar und Register. Wenn einst die Zeit gekommen sein wird, eine neue Geschichte der Astronomie zu schreiben, wird neben den Arbeiten von NALLINO dieses Werk als ein Grundpfeiler für den Neubau genannt und benützt werden müssen. Heute schon ermöglicht uns SUTER's Arbeit, als erste der in neuerer Zeit MUHAMMED IBN MŪSĀ gewidmeten Monographien, einen Einblick in geschichtliche Zusammenhänge, wie er vor zwanzig Jahren kaum erhofft werden konnte.

(Heidelberg)

JULIUS RUSKA

Karpinski, Louis-Charles. — ROBERT OF CHESTERS *Latin Translation of the Algebra of AL-KHOWARIZMI*. With an introduction, critical notes and an english version. 164 S. gross 8. (University of Michigan Studies, Humanistic Series, Vol. ix). New-York, MACMILLAN, 1915.

Nach Form und Inhalt ist L.-CH. KARPINSKI's Werk ein ebenbürtiges Seitenstück zu dem vorhin besprochenen Buche. Eine umfangreiche Einleitung gibt dem Leser alles Wissenswerte über Verfasser und Uebersetzer der ältesten Algebra. Wir lernen die geometrische Lösung quadratischer Aufgaben bei EUKLID (Buch II, 2) kennen und finden bei HERON und DIOPHANT die kühne Addition von Strecken und Flächen, bei den indischen Astronomen, die dem arabischen Zeitalter vorangehen, die algebraischen Regeln der Auflösung quadratischer Gleichungen. Die spärlichen Nachrichten über das Leben und die Schriften MUHAMMED BEN MŪSĀ's, des Astronomen aus Chwarazm (dem heutigen Chiwa), wie sie von AN-NADĪM, dem Verfasser der ältesten arabischen Bibliographie (Ende des 10. Jhdt. n. Chr.) und IBN AL-QIFĪ, seinem sorgsamem Nachfolger (um 1248 gest.) gegeben werden, die Anspielungen und Zitate späterer arabischer Mathematiker und Astronomen, die Arbeiten von NALLINO und SUTER über astronomische und geographische Tafelwerke AL-KHWĀRIZMĪS werden in einem zweiten Abschnitt vorgeführt. Der dritte Teil der Einleitung ist den *Uebersetzern* der Algebra gewidmet, die im 12. Jahrhundert — vor Beginn des zweiten Kreuzzugs — in Spanien Arabisch lernten und arabische Wissenschaft in mehr oder minder einwandfreies Latein übertrugen: « Learning was quite as international in that time as to-day ». Nicht vergessen sei, dass um 1143 ROBERT VON CHESTER auch die erste Koranübersetzung vollendete, ausdrücklich in der Vorrede darauf hinweisend, dass er dies nur als eine Abschweifung von seiner Hauptaufgabe betrachte, die der Uebersetzung astronomischer und mathematischer Werke gewidmet war, und dass eine Schrift über *Chemie* von ihm ebenfalls aus dem Arabischen übersetzt wurde (enthalten in MANGET, *Bibliotheca Chem.* I, 509-519).

Nach einem Ueberblick über den Einfluss der arabischen Algebra auf die Entwicklung der Mathematik im Abendland von LEONARDO PISANO's *Liber abaci* bis herab zu SCHEYBL, der um 1550 eine Neuauflage von ROBERT VON CHESTERS Uebersetzung zum Druck vorbereitete, kommt der Verf. in den weiteren drei Kapiteln auf das Verhältnis des von F. ROSEN 1831 mit englischer Uebersetzung herausgegebenen arabischen Originals zu den Uebersetzungen und auf die Handschriften der Uebersetzung von ROBERT VON CHESTER zu sprechen. Das Urteil über die ROSEN'sche Uebersetzung kann ich aus meinen eigenen

Untersuchungen bestätigen. Die Vergleichung der GERHARD VON CREMONA zugeschriebenen, von LIBRI 1838 herausgegebenen Uebersetzung und der ROBERT's mit dem Text zeigt, dass die erstere dem Text genauer folgt und besser ist. Die vier S. 44 erwähnten arabischen Termini haben übrigens auch modernen Uebersetzern wie ROSEN und NESSELMANN zu schaffen gemacht; sie sind von ROBERT nach der damals üblichen phonetischen Weise ganz anerkennenswert transcribiert (*almusarar* = *almusa*"ar, nicht *almusa'ir*), von GERHARD mit *pretium et appretiatum secundum positionem* bzw. *secundum quentem* geschickt übersetzt worden (vgl. meine Unters. *Zur ältesten arabischen Algebra und Rechenkunst*, Sitzgb. d. Heid. Ak. d. Wiss. 1917, S. 96-102). Dass die Vorrede des arabischen Textes und die Erbteilungsaufgaben, d. h. über die Hälfte des Werks in den lateinischen Uebersetzungen fehlen, ist lange übersehen worden und bei CANTOR nicht erwähnt, obwohl LIBRI darauf aufmerksam macht.

Von besonderm Interesse für den Philologen und Historiker sind natürlich KARPINSKI's Nachweise über die von ihm benützten Hss. und ihr gegenseitiges Verhältnis. Die peinlich genauen Angaben können hier nicht wiederholt werden. Die Ausgabe folgt dem Text des SCHEYBL-Manuskripts, das sich im Besitz der Columbia University Library befindet. Vier treffliche Facsimiletafeln geben eine Vorstellung von der äussern Beschaffenheit der vorhandenen Handschriften. Die Seiten 66 bis 125 füllt der Abdruck des lateinischen Textes und der Varianten (links) mit der englischen Uebersetzung und den Erläuterungen (rechts). Anhangsweise folgen *Addita quaedam pro declaratione algebrae*, den Schluss macht ein lateinisches Glossar.

Wir beglückwünschen den Herausgeber und die Historiker der Mathematik zu dieser schönen Gabe.

(Heidelberg).

JULIUS RUSKA.

Gathorne-Hardy, G. M. — *The Norse Discoverers of America.* The Wineland Sagas translated and discussed, in-8°, 304 p. Oxford, Clarendon Press, 1921.

About ten years ago FRIDTJOF NANSEN set out to demonstrate to the world that the stories about the so-called Norse discovery of the American continent belonged to the realm of myth and fiction. Clearly he has not succeeded. During the intervening years works have appeared on the subject by BABCOCK, HOVGGAARD, and STEENSBY (1), all of whom have opposed NANSEN. And now the fourth book has seen the light, from the pen of Mr. GATHORNE-HARDY, taking the same

(1) *Iris*, t. IV, p. 48.

view as they. Of the four his is, in my opinion, the weightiest; it is one of the really noteworthy books on the subject.

The two principal sources for this discovery are the *Saga of Eric the Red* and the *Tale of the Greenlanders*. The author does not give a separate translation of each of these, but pieces them together so as to present the most complete, continuous account of the events as he conceives them to have taken place, and he takes the Tale as the basis of his presentation. The rest of the Saga and passages from other sources bearing on the matter he gives in an appendix. This somewhat arbitrary procedure he justifies by maintaining that the Tale contains a fuller and more accurate account of all the voyages except that of KARLSEFNI. The Tale, he argues, represents the tradition preserved in Greenland, hence it is more reliable as to the exploits of the Greenlanders, while the Saga having originated in Iceland, is principally interested in KARLSEFNI, the only one of the leaders who returned there to live; each country being particularly curious about the doings of its own inhabitants.

Although certain things might be pointed out as apparently supporting this view of the Tale, there are others which seem to contradict it. I shall not discuss here the highly questionable account of BJARNI HERJULFSON's voyage nor that of LEIF's, which in many ways looks suspicious, but I shall grant that the Tale is evidently better informed about THORVALD's exploration than the Saga. Where, however, the author's argumentation collapses is in the case of KARLSEFNI and FREYDIS. He accepts the version in the Tale that theirs were two separate voyages, and rejects that in the Saga which makes FREYDIS one of KARLSEFNI's party. He finds the story about FREYDIS' treachery « one of the most natural, consistent and human episodes in history »; to me it sounds incredible, and under the circumstances almost impossible. But why should that story, if true, have been preserved in Greenland, and not a trace of it to be found in what the author calls the Icelandic tradition? This was not only an affair of Greenland; the slain crew were all Icelandic men and women, and nothing could be of greater interest to Icelandic audiences than an account of their cruel fate. Nor can it be plausibly argued that the story never may have reached Iceland, because the Tale itself informs us that KARLSEFNI was still in Greenland when FREYDIS returned, and he may well have wondered what had become of his countrymen, when he saw their ship in the hands of FREYDIS. Yet the Saga does not say a word about all this; on the contrary it gives a favorable picture of FREYDIS as a courageous woman. It looks as if the story was either a pure invention or a hazy remembrance, garbled beyond recognition, of the quarrel between the married and unmarried men mentioned in the

Saga. It is also worthy of notice that the Tale knows nothing of THORHALL the Hunter and his stanzas, although he was a Greenlander. I think this suffices to show that the Tale can hardly be looked upon as representing a reliable historical tradition of Greenland.

But if the Tale has made two expeditions out of one, the author is doubtless right in his contention that the Saga has done the opposite. There two voyages have been merged into one. It has almost forgotten THORVALD and his expedition; a faint echo of it is found in the account of KARLSEFNI's search for THORHALL, where THORVALD's death is recorded. I also think that the author is substantially right about the chronology of the voyages, that KARLSEFNI's took place several years later than the others, and that may explain the apparent uncertainty of his party as to the route. It will thus be found that the Saga and the Tale supplement one another, but while GUSTAV STORM and his followers have underrated the historical value of the latter, HOVGGAARD and GATHORNE-HARDY have greatly overrated it.

The author is at his best when refuting the theories of NANSEN. In treating the various incidents in the sources he also throws a new light upon many points, as in his conclusions about the term « *dægr* » being used some times for twelve hours, at other times for twenty-four. But especially felicitous is his observation on the « skin-boats », where he shows that whatever name the explorers applied to the boats of the Skraelings, it is evident that the uses which the savages are said to have made of these, point to the Indian canoe, but fit neither the kayak nor the umiak of the Eskimo. He is in agreement with other writers as to the discoverers' inability to make distinctions between Indians and Eskimos.

When it comes to identifying the localities mentioned in the sources there will always be divergences of opinion. The author's conclusions, or rather suggestions, as to that agree to a great extent with the generally discredited theories of RAEN. He thinks Helluland represents Labrador or New Foundland, preferably the latter, Markland Nova Scotia, Wonderstrands the coast of Cape Cod and Barnstable, Straumsey Fishers Island, Straumsfjord Long Island Sound, and Hlop the estuary of the Hudson River. Leaving the other names aside, it appears to me that this identification, at least of Wonderstrands and Straumsfjord is not supported by the Saga. It may be that the voyagers found the coast in question long, but I doubt if it could give them, Northerners as they were, an impression of desolation. And as to Straumsfjord it is clear that it must be sought outside the limits of the wild grapes; the author owes us an explanation of why grapes could not be found on Long Island Sound while they were plentiful at the mouth of the Hudson. There must have been a

greater distance between Straumsfjord and Hóp than the author assumes; if we are to place any confidence in the account regarding the climatic differences of these two places.

In any case Mr. GATHORNE-HARDY's interesting and well written book will convince the reader that we are dealing here with historical facts. But since we are on historical ground we ought to use the proper word to designate the nationality of these discoverers. It is customary to call them Norse, and this associates them in the mind of most people with Norway and Norwegians. So far as we know, they were, however, all natives of Iceland, except Eric the Red, and his part in these voyages is inconsequential. They should therefore be called Icelandic. To call them Norse is similar to calling Admiral PEARY an English explorer.

(Ithaca, N. Y.)

HALLDÓR HERMANSSON.

Heinrich Frick. — GHAZALĪ's *Selbstbiographie*. Ein Vergleich mit AUGUSTIN'S Konfessionen. Leipzig: HINRICHS, 1919. iv, 84 S. (Veröffentlichungen des Forschungs Instituts für vergleichende Religionsgeschichte an der Universität, Leipzig, N° 3).

This is a very careful and detailed comparison of GHAZZALĪ's *Munqidh* and AUGUSTINE's *Confessiones* considered as records of the spiritual developments and « conversions » of these authors. Dr. FRICK traces the evident agreements, almost verbal, in these experiences not to any borrowing but to a common basis in Neoplatonism. This is certainly right and nine-tenths of his further results will probably hold. But when he constructs the ultimate difference between the two theologians round the conception of personality his footing is less certain and his view would probably be corrected by a wider reading in GHAZZALĪ and in the other Moslem mystics. It is true that their ideas on personality have not been much studied by western scholars; but he might turn, in the first instance, to chapter II, « The Perfect Man », in R. A. NICHOLSON's recent *Studies in Islamic Mysticism*.

Further, that this little book is noticed here at all is due to the fact that GHAZZALĪ covered in his writings all the knowledge of his time from physics to metaphysics and that our present rather arbitrary limitations as to what may be called « science » do not hold in the slightest in his world. The student there must be ready to look everywhere or he is certain to lose much. Thus the connection of this book with our modern « science » is through psychology.

(Hartford, Con.)

D. B. MACDONALD.

José A. Sánchez Pérez. — *Compendio de Álgebra de ABENBÉDER*. Texto árabe, traducción y estudio. Junta para ampliación de estudios e investigaciones científicas, t. XLVII, 117 und 77 S. Madrid, 1916

Mit diesem Werke betritt ein spanischer Gelehrter das Feld historischer Erforschung der Mathematik; freudig begrüßt von allen, die sich bewusst sind, wie viel ungehobene handschriftliche Schätze noch in spanischen Bibliotheken ruhen und ihrer Verwertung in einer Geschichte der Wissenschaften auf spanischem Boden entgegensehen.

Gewiss kann man darüber verschiedener Meinung sein, ob die arabischen Schriften über Mathematik und andere Wissenschaften, die aus der Vernichtung der maurischen Kultur gerettet sind, als Gegenstand einer Geschichte der spanischen Mathematik angesehen werden können. Warum sollten aber Sprach- und Volksschranken gerade an der Stelle, von wo Jahrhunderte lang der Glanz der maurischen Wissenschaft nach allen christlichen Ländern ausstrahlte und wissbegierige Jünger anzog, schärfer gezogen werden als anderwärts? Ist das, was wir islamische Wissenschaft nennen, nicht selbst wieder nur griechische Wissenschaft in fremdem Gewande? Wenn das Spanien von heute sich anschickt, durch Erforschung der Reste jener in der Geschichte des menschlichen Geistes hochangesehenen Epoche an seinem Teil eine alte Dankesschuld abzutragen, so kann diese Erneuerung alten Ruhmes den Geschichtsforscher nur mit Genugtuung erfüllen.

Die veröffentlichte Handschrift ist von CASIRI in seiner *Bibliotheca Arabico-Escorialensis* unter Nummer CMXXI beschrieben. Ueber den Autor IBN BADR war nichts Näheres festzustellen; die Handschrift wurde im Jahr 1343 n. Chr. vollendet. Höchst eigentümlich ist eine später zugefügte Blattzählung, da die Zeichen für die Zehner von den entsprechenden Einern völlig verschieden sind. In seinen theoretischen Ausführungen geht der Autor nicht über MUHAMMED BEN MUSA ALHWĀRAZMI hinaus, er kennt aber auch die Algebra des ABŪ KAMIL ŠUGŪ' IBN ASLAM (S. 57 d. Uebers.) Eine bunte Auswahl von Textaufgaben, insbesondere Bewegungsaufgaben, bildet den zweiten Teil. Auf diesem Gebiet bleibt noch viel zu sammeln, ehe man instande sein wird, den Inhalt von LEONARDOS *Liber abaci* mit arabischen Gegenbeispielen zu belegen.

Die Uebersetzung ist fortlaufend mit Fussnoten versehen, in denen die in Worten ausgedrückten Operationen in unsere gewohnten Zeichen übertragen sind. Das Ganze ist ein würdiges Gegenstück zu ROSENS Ausgabe und Uebersetzung der ältesten arabischen Algebra.

(Heidelberg).

JULIUS RUSKA.

C. I. Gerhardt. — *The early mathematical manuscripts of LEIBNIZ*, translated from the latin texts with critical and historical notes, by J. M. CHILD, un vol. in-12, 238 p. The Open Court Publishing Company, Chicago et Londres, 1920.

La controverse relative aux rôles respectifs de LEIBNIZ et des savants anglais dans la création du calcul infinitésimal a fait couler des flots d'encre pendant deux cents ans et il semble qu'elle ne soit pas encore close. D'une part, en effet, le dépouillement des manuscrits de LEIBNIZ permet de verser dans le débat de nouvelles données. D'autre part, l'application à tous les textes d'une méthode critique rigoureuse nous met à même d'établir solidement certains faits et certaines dates et de réfuter ainsi certains arguments qui étaient fondés sur des raisons de sentiment. C'est du moins ce qu'a pensé — très justement, croyons-nous — J. M. CHILD. A l'histoire du calcul infinitésimal il apporte une contribution nouvelle en publiant une série d'écrits de LEIBNIZ judicieusement choisis et en les discutant avec autant d'érudition que de perspicacité.

Tout lecteur impartial devra rendre hommage à la science de CHILD. Si l'on n'est pas absolument convaincu par son argumentation, cela tient à ce que la base de discussion dont il dispose n'est peut-être pas encore suffisamment large pour justifier des conclusions qui nous obligent à mettre en doute la parole de LEIBNIZ lui-même. La critique de textes de CHILD se trouve venir un peu trop tôt. En effet, un nouveau dépouillement des manuscrits de LEIBNIZ — beaucoup plus complet que le dépouillement de GERHARDT aux publications duquel CHILD emprunte sa documentation — a été entrepris il y a une quinzaine d'années sous les auspices de l'Association internationale des Académies. Les notes et écrits mathématiques de la jeunesse de LEIBNIZ, notamment, ont été étudiés de très près par ALBERT RIVAUD, et nous croyons savoir que ces documents jettent une vive lumière sur la formation des idées de LEIBNIZ pendant son séjour à Paris et sur les influences qu'il a subies par l'intermédiaire de HUYGENS. Il faut attendre l'analyse que RIVAUD nous donnera de ces manuscrits avant de porter un jugement définitif sur les premiers travaux mathématiques de LEIBNIZ. Cette réserve faite, on doit reconnaître qu'il est fort utile de déterminer avec précision l'état où se trouve la question après les publications de GERHARDT. C'est là justement ce que CHILD a voulu faire.

La thèse de CHILD se résume dans l'appréciation suivante. LEIBNIZ, quoi qu'on en ait dit, n'a nullement plagié NEWTON et n'a pas eu besoin de lui rien emprunter. Par contre, il a, en quelque sorte, « récrit » le livre de BARROW en le traduisant dans le langage de la géométrie ana-

lytique de DESCARTES et en le simplifiant à l'aide d'un remarquable système de notations qui lui est propre (p. 231).

Sans doute, si l'on prenait à la lettre les déclarations de LEIBNIZ, ce n'est pas ainsi que les choses se seraient passées. LEIBNIZ ne devrait presque rien à BARROW, dont il reconnaît avoir acheté les *Leçons* en 1673, mais dont il n'aurait à peu près rien lu. Par contre il devrait beaucoup aux traités de PASCAL dont HUYGENS lui avait recommandé l'étude. — Selon CHILD cependant, si LEIBNIZ est certainement de bonne foi et si l'on peut accepter ses dires quand il s'agit des grandes lignes et des généralités, il devient en revanche sujet à caution sitôt qu'on descend dans les détails. CHILD le prouve en signalant diverses confusions et erreurs matérielles commises par LEIBNIZ. Et il estime que, lorsque LEIBNIZ essaye de relater après trente ans écoulés l'histoire de sa pensée, sa mémoire le trahit probablement.

Or, en analysant de près les premiers écrits de LEIBNIZ, CHILD observe que le savant peut fort bien avoir été conduit au point de vue qu'il adopte, aux expressions qu'il emploie, aux figures qu'il trace, sans se servir des *Lettres* de DELTONVILLE et en s'inspirant simplement (quant au fond) de CAVALIERI et de BARROW. La méthode suivie par PASCAL pour déterminer les centres de gravité des solides en utilisant la notion de moment est déjà esquissée dans CAVALIERI (p. 209). Le *triangle caractéristique* et ses applications sont déjà aperçus par BARROW. — D'ailleurs, nous pouvons parfaitement admettre que LEIBNIZ, comme il le dit, n'a point lu tout de suite avec attention les *Leçons* de BARROW après les avoir achetées. CHILD suppose que LEIBNIZ voyage sans cesse avec son BARROW et qu'il y puise successivement, à des dates diverses, différentes idées. La notion de différentielle, en particulier, et l'idée première de l'intégrale contenant le facteur dx sous le signe de sommation, seraient ainsi directement empruntées par LEIBNIZ à BARROW (p. 125).

Pour ce qui est du développement de la théorie différentielle sous forme géométrique, d'autre part, CHILD estime que c'est dans la *Géométrie* de DESCARTES que LEIBNIZ a trouvé le point de vue qu'il a adopté et le principe de la méthode des coordonnées. CHILD est ici d'accord avec la plupart des historiens.

Enfin, l'appareil de notations et de calcul que nous trouvons chez LEIBNIZ lui appartiendrait en propre et serait même probablement son principal titre de gloire. D'après CHILD, en effet, LEIBNIZ aurait peut-être été le premier à reconnaître l'importance du rôle du calcul et de la logique en général dans la découverte (p. III). Les opérations presque mécaniques qu'implique le calcul constituent un puissant instrument d'invention : « C'est là un fait qui, depuis le temps de LEIBNIZ, a été explicitement ou implicitement reconnu par tous les plus grands analystes ».

Que penser de ces diverses conclusions et manières de voir ?

Nous croyons qu'il y aurait quelques réserves à faire sur le dernier point. L'idée de faire du calcul un instrument essentiel de la découverte n'est point nouvelle au temps de LEIBNIZ. C'est au fond l'idée de RAIMOND LULLE et de la plupart des promoteurs de l'algèbre au Moyen-Age et pendant la Renaissance. C'est l'idée qui, sous une forme moins systématique que celle qu'elle prendra chez LEIBNIZ, est à la base de la *Mathesis universalis* de DESCARTES. Mais c'est là un point qui n'a qu'une importance secondaire dans l'exposé de CHILD.

La question qui a trait à l'influence exercée sur LEIBNIZ par HUYGENS et PASCAL est autrement importante. Pour amoindrir cette influence, CHILD doit contester plusieurs récits formels de LEIBNIZ. Il est obligé d'incriminer la mémoire du savant de Hanovre, et il va même finalement jusqu'à lui attribuer certains sentiments qu'il qualifie de « très humains et très naturels », mais que d'autres jugeraient plus sévèrement. LEIBNIZ, suppose CHILD, a lu PASCAL en même temps que BARROW. Aussi quand, trente ans plus tard, accusé d'avoir plagié les auteurs anglais, il entreprend de relater l'origine de sa pensée, il est tout naturellement porté à insister sur celle des sources de ses travaux qu'on ne lui reproche pas d'avoir pillée (p. 16). Et, à force de répéter cette erreur, il finit par y croire. — On estimera sans doute qu'une pareille interprétation des faits reste extrêmement hypothétique. CHILD, lui-même, ne le contestera pas, et il faut reconnaître que quiconque prétend déduire les sources d'une théorie de l'étude directe et objective de cette théorie, s'expose fatalement à pareil inconvénient. En cherchant bien, on trouvera toujours des analogies entre un écrit scientifique nouveau et les écrits antérieurs. Ce n'est pas en procédant à de telles comparaisons qu'on peut *avec certitude* déterminer les influences qui ont réellement et profondément agi sur la pensée d'un auteur.

Pour conclure, nous devons souhaiter qu'un nouvel examen de la question litigieuse soit fait bientôt à la lumière des documents encore inédits. Mais, quoi que doive nous apporter l'avenir, CHILD aura eu le grand mérite de mettre exactement au point plusieurs problèmes historiques délicats et d'en proposer des solutions pénétrantes.

(Paris.)

P. BOUTROUX.

Johann Kepler. — *Die Zusammenklänge der Welten...* herausgegeben und übersetzt von OTTO J. BRYK. (Klassiker der Naturwissenschaft und Technik), LII + 368 S. Jena, DIEDERICHS. 1918.

It is interesting to compare those two great contemporaries, GALILEO and KEPLER, the former endowed with a mind as clear as crystal, the latter who lived to his last day in a mist of occultism.

The writings of the former are models of clear, terse, beautiful language; they are amongst the greatest classics of scientific literature; they have been very often published and many more editions and translations of them will appear in the future; those of the latter on the contrary are almost repulsive by their prolixity, obscurity and mysticism. They contain some treasures of inestimable value, but who will have the courage to look for them in the enormous mass of verbiage wherein KEPLER chose to bury them?

It is no wonder then that the greatest part of KEPLER's works has not yet been translated into any modern language. A complete edition in the original Latin was published by CHR. FRISCH, 8 vol. in 9 parts, Francfort 1858 to 1871, but the only translations I know of are LUDWIG GÜNTHER's of the *Astronomia lunaris*, 1628 (KEPLER's Traum vom Mond, Leipzig 1898) and H. PLEHN's of the *Dioptrice*, 1611 (OSTWALD's Klassiker, 144, 1904). OTTO J. BRYK has had the excellent idea of preparing a German translation of some of the most important writings hitherto available only in Latin; that is, an abridged translation or rather a translation of long extracts quoted *in extenso* and connected by brief summaries. He thus enables us to read KEPLER without the risk of getting hopelessly stuck in the swampy places. Who is it who said that our admiration for KEPLER would have been far greater if the largest part of his writings had been lost? OTTO J. BRYK has tried to render this service to the great man and he has done it very well.

The text thus translated are the following : 1. the *Mysterium cosmographicum*, Tübingen 1596 (« Prodomus dissertationum cosmographicarum, continens Mysterium cosmographicum, de admirabili proportione orbium coelestium, deque causis coelorum numeri, magnitudinis, motuumque periodicorum genuinis et propriis, demonstratum per quinque regularia corpora geometrica ») p. 131-183;

2. The *Astronomia nova* of 1609 (« *Astronomia nova*, Αἰτιολογητός seu Physica coelestis, tradita commentariis de motibus stellae Martis, ex observationibus G. V. TYCHONIS BRAHE ») p. 185-319. This contains the two first laws of planetary motion.

3. The *Dissertatio* in answer to GALILEO's *Sidereus nuncius* (Venice 1610) published in Prague in the same year, p. 321-355.

4. Short extracts from the *Dioptrice* (1611), problems 86-89, p. 356-359.

5. The « *Harmonices Mundi libri V quorum primus geometricus...*, secundus architectonicus, seu ex geometria figurata..., tertius proprie harmonicus..., quartus metaphysicus, psychologicus et astrologicus... quintus astronomicus et metaphysicus... » Linz, Austria, 1619 (p. 1-130).

The latter translation is placed at the beginning of the whole work

and, strangely enough, gives its title to it. Only books 4 and 5 are translated after a brief summary of the three first ones. One will remember that the third law of KEPLER is explained in the third section of book 5 (p. 66 sq.).

The editor has provided a biographical introduction, brief but helpful marginal notes, a short bibliography; and he has adorned the text with well chosen illustrations (portraits, facsimiles, etc.). In short, this is a very welcome publication.

SARTON.

Xavier Léon. — *FICHTE et son temps*. I. Etablissement et prédication de la doctrine de liberté. La vie de FICHTE jusqu'au départ d'Iéna (1762-1799), xvi + 652 p.. avec portrait. Paris, ARMAND COLIN, 1922. [30 fr.].

Je salue avec plaisir l'apparition du premier volume de l'œuvre monumentale que XAVIER LÉON (le fondateur et directeur de la *Revue de métaphysique et de morale*) élève à la mémoire de FICHTE. La vie de celui-ci se divise assez naturellement en trois périodes limitées d'une part par les dates de la naissance et de la mort du grand philosophe 1762-1814, d'autre part par deux coupures d'importance essentielle : 1799 l'exil d'Iéna, le départ pour Berlin et 1806 la bataille d'Iéna, puis la guerre pour l'affranchissement de l'Allemagne, le mouvement républicain, la fondation de l'Université de Berlin. Un volume sera consacré à chacune de ces trois périodes et l'auteur espère que les vol. 2 et 3 pourront paraître en 1923 et 1924.

L'œuvre de FICHTE ne nous intéresse pas directement, mais elle ne peut nous laisser indifférents. S'il est vrai de dire que KANT, dans sa *Critique*, a en quelque sorte donné la théorie fondamentale de la Révolution française — qui fut faite au nom de la liberté, de la dignité humaine — il faut ajouter que FICHTE compléta son œuvre, car il fut essentiellement le philosophe de la liberté. Sa carrière est à ce point de vue d'une remarquable unité. Ses œuvres de début de 1791 à 1793 sont sa *Critique de toute Révélation*, puis la *Revendication de la liberté de penser auprès des princes de l'Europe qui l'ont opprimée jusqu'ici*, enfin sa courageuse défense de la Révolution intitulée *Contributions destinées à rectifier les jugements du public sur la Révolution française*. En 1794 paraît alors son œuvre maîtresse : la *Théorie de la Science*, sorte d'Evangile de la Raison à la défense et au développement duquel la meilleure partie de sa vie allait être dévouée. Mais l'ami de la Révolution française n'est point découragé par les événements qui bouleversent le monde et saccagent sa propre vie. Après 1806 il devient l'apôtre de la liberté de son pays contre l'impérialisme napoléonien.

On peut dire que jusqu'à sa mort en 1814 il n'abandonna jamais la lutte pour son idéal de liberté et de raison. « Il a donné au monde l'exemple, toujours rare, d'un philosophe ayant pleinement vécu sa philosophie ».

L'ouvrage auquel XAVIER LÉON a consacré trente ans de sa vie est basé sur tous les documents déjà publiés, mais aussi sur une partie des pièces inédites conservées à la Bibliothèque de Berlin. Certaines de celles-ci sont imprimées dans les appendices. Il faut se féliciter de ce que cette étude approfondie d'un grand philosophe allemand ait été entreprise par un philosophe français. Puisse-t-elle être menée bien vite à bon terme! L'auteur aura rendu un grand service à son pays et à l'humanité s'il parvient à vaincre le plus grand ennemi qui menace notre pensée en ce moment : la Haine jalouse et bête, la Haine qui ne peut que détruire, la Haine stérile.

SARTON.

Max Neuburger. — *Das alte medizinische Wien in zeitgenössischen Schilderungen.* In-8°, x-264 S., 9 illustrations. Wien und Leipzig, MORITZ PERLES, 1921.

Previous to NEUBURGER all accounts of the old Vienna School have been based upon official acts « sur place » and upon an all too local medical literature. NEUBURGER in the present work makes a decidedly new departure from the plan of HECKER, LEBERT, PUSCHMANN, PETERSEN. He has plundered the diaries, day-books, travels and memoirs of a whole generation of visitors to Wien and excerpted all the material bearing upon the masters of the Viennese School and the institutions in which they worked, from the days of VAN SWIETEN to the Vienna Congress. In and out of book and journal, we are led, in this manner, to a view of the Old School, at once intimate, impartial, engaging. Freshness and intellectual candour bloom on every page. Swiss, Danes, Frenchmen. Englishmen and North Germans, with intermingled praise and dispraise, lend their competent pens to compose this extraordinary series of first-hand impressions. Their composite picture of medical Wien is complete in every essential detail, and is absolutely convincing in its utter sincerity. NEUBURGER includes some very choice estrays in this volume. His work betokens control of a vast literature wherein « expertise » and a gift of nice selection are prerequisites. His explanatory foot-notes are in the nature of commentaries on the text or condensed biographies of the writer from whom the selection is taken. They operate as a continuous orienting medium and form indeed the very sinew of the work. His notes on VAN SWIETEN, ANTON DE HAEN and MAXIMILIAN STOLL are particularly full and illuminating. Every phase of medical activity in

Wien is touched upon, either in the excerpts, which number just short of thirty, or in the ample notes of the editor. The book is a study in temperaments and varying view-points. The genial observer whose stay in Wien was short and sunny, and the crabbed and splenetic, whose stay was long, here jostle one another. Some set their wits against their old masters and show malice, while others, without a word of mildest censure, acclaim the whole medical polity of Wien, « seat of Science and the Muses, Mecca of physicians ».

Medical Vienna thus seen through the eyes of contemporaries (medical men coeval with, and more or less associated with, the supreme masters of the Old School) holds a fascination for the reader that bids fair to pass the expectation of the devoted compiler of these *obiter dicta*. NEUBURGER has injected new thrills, fresh emotion and a dash of high comedy into the story of the Old School, by simply impounding the comments of a series of travelers and truthseekers who have jotted down their impressions in most unpremeditated fashion. Under a frank irruptive stroke of their qualities you will find that honest « *Memorien* » and « *Erinnerungen* » such as form the source-material of this book cleave rather close to the truth, all things considered. This extramural method of gathering material is novel, ingenuous, productive of substantial results. It might well be tried out in the case of earlier medical groups and schools elsewhere.

Boston.)

EDWARD C. STREETER.

H. C. Ørsted. — *Correspondance avec divers savants*, publiée par M. C. HARDING, 2 vol., xvi + 367 p.; xii + 664 p. Copenhague, H. ASCHEROU, 1920.

Il faut être reconnaissant à l'éditeur de ces lettres, professeur au Polyteknisk Laereanstalt de Copenhague, et à la Fondation CARLSBERG, qui en a assuré la publication, de nous avoir donné ainsi les moyens de mieux comprendre la grande personnalité de H. C. OERSTED (1777-1851). Le centenaire de la fondation de l'électromagnétisme ne pouvait être célébré plus dignement. Le premier volume et une bonne part du second sont consacrés aux correspondances les plus volumineuses : avec l'électricien allemand JOHANN WILHELM RITTER (1776-1810) de 1801 à 1809 (celle-ci sera particulièrement intéressante pour l'étude de la genèse de la découverte d'OERSTED); avec CHRISTIAN SAMUEL WEISS (1780-1850), minéralogiste allemand, de 1806 à 1848; avec JAC. BERZELIUS (1779-1848) de 1810 à 1847; avec CHRISTOPHER HANSTEEN (1784-1873), mathématicien et astronome norvégien, qui s'est occupé surtout du magnétisme terrestre, de 1810 à 1851. Le reste du deuxième volume nous donne la correspondance d'OERSTED avec un assez grand nombre

de savants européens (65). Il serait trop long de les énumérer et peu utile, car il faut bien avouer que certains d'entre eux ne sont représentés que par des lettres sans aucune importance (lettres de recommandation ou de pure courtoisie). Je me bornerai à dire que l'historien de la physique dans la première moitié du XIX^e siècle devra se donner la peine d'éplucher cet ouvrage. A vrai dire, tout en reconnaissant le zèle dont l'éditeur de ces lettres a fait preuve — car il ajoute au texte des notes nombreuses et un bon index biographique — je dois dire qu'à mon avis il n'a accompli que la première partie de sa tâche. Il n'aurait pas dû obliger les historiens de la physique à patanger à travers tant de lettres tout à fait futiles : il aurait pu se borner à indiquer l'existence et le sujet de celles-ci (1), ou tout au moins il aurait dû les faire imprimer en caractères plus petits. D'autre part, dans les préfaces il aurait dû insister davantage et avec plus de précision sur l'intérêt scientifique que présente chaque correspondance. De plus, il aurait pu nous donner un index chronologique et un index des sujets traités. Enfin, je me vois contraint de faire remarquer que les notes, rédigées en français, ne sont pas toujours correctes. Il eût été utile de les faire corriger par un Français (il y a beaucoup de fautes, par exemple dans l'emploi des temps).

Signalons les noms des correspondants qui occupent le plus de place dans cette collection : ARAGO, BREWSTER, CHEVREUL, DAVY, FARADAY, FORCHHAMMER, GAUSS, GEHLEN, HAUSSMANN, JOHN HERSCHEL, ALEX. VON HUMBOLDT, MITSCHERLICH, J.-B. VAN MONS, MURCHISON, PFAFF, PICTET, POGGENDORFF, QUETELET, SCHUMACHER, SCHWEIGER, WEBER, WHINSTONE, WINTERL. Un rapide examen de cette liste nous montre qu'elle contient les noms de plusieurs savants qui n'étaient point des physiciens; nous voyons donc tout de suite qu'une bonne partie de cette correspondance n'est pas scientifique, mais plutôt académique et officielle. Aux lecteurs américains je signalerai encore une lettre intéressante de JOSEPH HENRY (Princeton 1841) où celui-ci raconte brièvement l'histoire de ses propres expériences. SUTTON.

Holland Thompson. — *The Age of Invention*. A chronicle of mechanical conquest. xii + 267 p. 13 illustr. New Haven, Yale University Press 1921.

This beautiful volume is one of the fifty forming the collection named « The Chronicles of America » edited by ALLEN JOHNSON, Prof. of American history in Yale University. To quote the preface « it is not

1 Ceci s'applique surtout aux lettres écrites en langue scandinave, car toutes les lettres sont publiées dans la langue originale.

intended to be a complete record of inventive genius and mechanical progress in the United States... All it seeks to do is to outline the personalities of some of the outstanding American inventors and indicate the significance of their achievements ». The treatment is popular but of the best kind; the story is told in a pleasant manner, the emphasis being skilfully laid on the main points; the principal inventions are well explained though one may regret that the avoidance of technical details has been carried perhaps too far. I suspect that the chief editor of this literary collection is largely responsible for the omission of anything which might smack too much of science or technology. He is certainly responsible for the fact that the history of the telephone has not been included in THOMPSON's book, but has been treated in another volume of the same collection : *The age of big business* by BURTON J. HENDRICK. This seems to me an extraordinary incongruity. It is true that the development of the telephone influenced « big business » to a degree, but so did every fundamental invention.

I have great confidence in the author at least in so far as he sticks to his own subject of which he has apparently a good knowledge. It would have been better for him to leave out altogether such loose statements as these : « We find mention of cotton in India fifteen hundred years B. C. » or « the ancient Greeks had steam engines of a sort ». HOLLAND THOMPSON has very well shown the relations between the great technical discoveries and their social backgrounds : for example, the connection between the discovery of the cotton gin and slavery. European readers may not realize that in 1793 slavery was a dying institution, North and South. WHITNEY's gin created the immense cotton industry of the South and together with it, a terrible recrudescence of slavery. Another interesting story is that of the « idyllic » factories of Lowell which CHARLES DICKENS saw in 1842 and described in his *American Notes*. Alas ! are they gone for ever ? May we never hope to see again industrial conditions combined with so much culture and humanity ?

An account of FRANKLIN's life and research has provided the author with a very natural introduction. This first chapter also explains the beginning of the patent system, which was such an encouragement to inventors. The first federal patent act dates of 1790 ; it was soon replaced by the second patent act in 1793, but the latter, with some amendments, remained in force until 1836, when the present Patent Office was organized. It will suffice to enumerate the following chapters : ELI WHITNEY and the cotton gin. Steam in captivity. Spindle, loom and needle in New England. The agricultural revolution. Agents of communication. The story of rubber. Pioneers of

the machine shop. The fathers of electricity. The conquest of the air. The book is completed by a short but good bibliography, chapter by chapter.

HOLLAND THOMPSON was born in Randolph County, N. C. in 1873; he is professor of history at the College of the City of New York. He has written various books on American history (notably *From cotton field to cotton mill* in 1906) and is the American editor of the *Book of Knowledge*, an encyclopaedia for children.

The Yale University Press deserves warm praise for the material execution of this book : the type is one of the best I have seen in a modern edition, the paper is fine and the illustrations are excellent.

G. SARTON.

Olga Metchnikoff. — *Vie d'ELIE METCHNIKOFF* (1845-1916), viii + 272 p. (210×150). Paris, HACHETTE, 1920. [12 fr.]

A. Besredka. — *Histoire d'une idée. L'œuvre de METCHNIKOFF*, 135 p. (200×150) avec un portrait. Paris. MASSON et Cie, 1921.

Il faut savoir beaucoup de gré à M^{me} METCHNIKOFF de nous donner le précieux monument qu'elle vient d'élever à la mémoire de son mari, monument que l'on sent d'une sincérité absolue, sans réticence aucune, dont le projet avait d'ailleurs été formé du vivant de METCHNIKOFF, et duquel il a connu quelques chapitres.

C'est bien là en effet le tableau d'une *vie*, et non pas un panégyrique plus ou moins dissimulé, ou un compte rendu sec et aride de travaux de laboratoire et de mémoires. Certes, on y trouve résumés en un langage clair la plupart des travaux du savant, mais ils ne sont là que parce que « la vie et l'œuvre d'ELIE METCHNIKOFF sont si intimement liés que, dans une biographie, il est impossible de les séparer ».

De même que l'œuvre du savant révèle une extraordinaire unité de vues — c'est en effet l'idée de la digestion intracellulaire (1874), née dans le domaine de l'embryologie comparée, qui conduit directement aux doctrines de l'inflammation, de l'immunité, et de la dégénérescence sénile. — de même sa vie toute simple nous montre un homme avant tout préoccupé par la recherche scientifique, par la diffusion de ses idées, ou la vulgarisation des règles d'une hygiène normale. Aux moments les plus pénibles de son existence, pendant la longue maladie de sa première femme, alors que les soucis d'argent s'ajoutaient à la peine morale, le travail de laboratoire n'était pas interrompu, sauf lorsque METCHNIKOFF, à force d'avoir usé ses yeux au microscope, pouvait craindre pour sa vue; et alors il partait en expédition anthropologique chez les Kalmouks. Non plus pendant son professorat à Odessa, où il avait à se débattre au milieu de difficultés administratives, où il eut

d'ailleurs sa première crise cardiaque grave, et dont il démissionna à la suite d'intrigues politiques.

Pendant cette première partie de sa vie, qui s'étend jusqu'à l'époque des travaux d'où découlera la théorie de la phagocytose (1883), METCHNIKOFF est un pessimiste, comme le manifestent clairement d'ailleurs deux tentatives de suicide, l'une suivant la mort de sa première femme, l'autre venant après la crise cardiaque dont il vient d'être question. Cette seconde tentative présentait, au surplus, un intérêt expérimental : METCHNIKOFF s'était inoculé la fièvre récurrente, voulant constater en même temps qu'elle était transmissible par le sang ; l'expérience eut malheureusement un résultat positif, et l'état du cœur du malade s'en trouva aggravé. Le pessimisme de cette période n'est cependant pas dû aux chocs successifs qu'avait reçus METCHNIKOFF ; il a des causes plus profondes qu'il faut trouver dans ses idées sur les désharmonies de la nature humaine (en particulier, décalage croissant entre l'époque de la puberté et celle du mariage, dans les sociétés civilisées), désharmonies qui, pensait-il, devaient aboutir à une décadence définitive de l'humanité.

Mais dès le début des recherches sur la phagocytose, une autre direction philosophique apparaît. Dans la première communication faite sur ce sujet, en 1883, à Odessa, on voit poindre une orientation vers l'optimisme. Cette philosophie optimiste de METCHNIKOFF, développée dans ses *Etudes sur la nature humaine* (1903), et ses *Essais optimistes* (1907), est trop connue pour que nous en parlions ici.

Russe, ayant vécu surtout en Russie jusqu'à son installation à l'Institut Pasteur (1888), METCHNIKOFF ne s'est néanmoins, malgré sa nature généreuse, jamais occupé activement des intrigues politiques, des tendances sociales, qui captivaient l'activité d'un si grand nombre de ses compatriotes. Il a connu cependant à Genève le centre révolutionnaire qui s'était formé autour de HERZEN ; sa conviction de la suprématie de la science sur la politique s'est trouvée largement fortifiée à ce contact : plus tard, il connut BAKOUNINE qui, comme HERZEN, n'exerce sur lui aucune influence. Il semble que n'aient vraiment fait sur cet homme une impression profonde que PASTEUR et TOLSTOÏ : par l'un et par l'autre, il est conquis dès l'abord ; de l'un et de l'autre, il parlera toujours avec émotion.

Emotif, il l'était très fortement, comme en témoignent l'origine de ses deux mariages, sa sensibilité devant les calmes spectacles de la nature, son culte pour BEETHOVEN, et aussi quelques phobies qui s'atténuèrent à mesure que l'homme prenait de l'âge.

L'âge ! On sait les idées de METCHNIKOFF sur la vieillesse et qu'il considérait qu'une hygiène rationnelle devait la faire disparaître, au profit du « besoin de la mort », venant très tard, sans cette période prémoni-

toire si pénible pendant laquelle l'homme se sent vieux. Le récit de ses derniers jours, sans cesse troublés par cette idée, est, sous la plume de M^{me} METCHNIKOFF qui souvent ici nous donne les auto-observations de son mari, à la fois tragique et très beau, beau par la foi que conserve le savant dans l'idéal rationaliste qui l'a toujours guidé, et par son calme devant l'inévitable mort, comme s'il avait eu le besoin de la mort, ce besoin qu'il prétendait tout aussi normal que le besoin de repos après une journée de labeur.

L'ouvrage se termine par un index des publications de METCHNIKOFF. On aurait aimé y trouver une reproduction des traits du grand savant dont l'Institut Pasteur, auquel il a donné près de trente ans de sa vie, conserve pieusement les cendres.

Le petit volume de A. BESREDKA qui est un des meilleurs parmi les disciples de METCHNIKOFF, et l'un de ses derniers collaborateurs, complète très heureusement la biographie écrite par M^{me} METCHNIKOFF; il constitue un exposé magistral de l'œuvre du maître par l'un de ceux qui ont le mieux connu le développement de sa pensée scientifique.

L. GUINET.

J. Alfred Sharp. — DAVID LIVINGSTONE, *missionary and explorer*, 239 p., 2 ill. London, The Epworth Press, 1920.

[6 shillings.]

This new life of LIVINGSTONE (1813-73) is not based upon any new documents, but the author has made good use of the materials already published by former biographers and he has told his story agreeably and simply, as befitted the noble figure he was portraying. The story is told chiefly for missionaries, and emphasis is laid on LIVINGSTONE's missionary activities rather than on his geographical work.

Yet the account of his explorations is sufficient for most readers, excepting of course the professional geographer. As I have remarked before (*Isis*, I, 97), however great his geographical discoveries, the triumph obtained by LIVINGSTONE in the moral sphere was of far greater importance. He it was who gave its death-blow to the slave trade. The story of LIVINGSTONE's life is one of the most romantic and the most inspiring I have ever heard, and I was quite glad to have it retold to me in a new fashion. The meeting of LIVINGSTONE and STANLEY in Ujiji on Friday, November 10, 1871, is one of the most touching episodes I know of. But above all, I will never tire of hearing of the extraordinary devotion which LIVINGSTONE's coloured servants showed to him after his death in April 30, 1873. To quote SHARP: « There is nothing finer in the whole sweep of history than the way in which his

faithful negro followers acted in the great extremity to which the death of their master had brought them ». They carried his body amidst innumerable dangers and difficulties from Chitambo's village at the south side of Lake Bangweolo to Bagamoio, — a journey of almost eight months. This tribute to a very great man was in every respect worthy of him; it at once placed his humble servants on his own level.

G. SARTON.

L'Académie royale de Belgique depuis sa fondation (1772-1922), 343 p. Bruxelles, LAMERTIN, 1922.

L'Académie a eu l'heureuse idée de célébrer le 150^e anniversaire de sa fondation par la publication d'une brève histoire de son activité. Ceci ne manquera pas d'inspirer à ses membres de nouveaux efforts. Cette histoire se divise en trois périodes : la période autrichienne ou de création, de 1772 à 1794, puis, après un sommeil de vingt-deux ans, la période néerlandaise ou de réorganisation, de 1816 à 1830; enfin, depuis 1830, la période nationale. Une seconde interruption fut causée par l'invasion allemande de 1914 à la fin de 1918. L'historien doit rapporter que le Palais des Académies fut envahi le 20 août 1914 par les troupes allemandes, au mépris de la Convention de La Haye; qu'elles l'occupèrent jusqu'à la fin de leur séjour en Belgique et l'abandonnèrent dans un état immonde, après avoir détruit ou volé une grande partie des trésors (livres, archives, médailles, œuvres d'art, meubles) qui y étaient gardés (1).

Ce mémorial est divisé comme suit : le secrétaire-perpétuel, PAUL PELSENEER, nous donne d'abord (p. 7-34) l'histoire générale de l'Académie. Ceci est suivi par l'histoire des différentes classes et sections : les sciences mathématiques et physiques par PAUL STROOBANT; les sciences biologiques par J. MASSART; les sciences minérales par P. FOURMARIER; les sciences historiques par H. PIRENNE; les sciences philologiques par P. THOMAS; les sciences juridiques par G. CORNIL; les sciences philosophiques par LÉON LECLÈRE; les sciences économiques par ERN. MAHAIM. Les rapports déjà cités constituent l'histoire de la classe des sciences et de la classe des lettres et remplissent les chapitres II et III. Un quatrième chapitre est consacré à la classe des beaux-arts (1845-1922), et un dernier à l'histoire des fondations de l'Académie.

Plusieurs collaborateurs sont parvenus à éviter le style soporifique des rapports administratifs et quelques-uns ont poussé l'art si loin qu'il

(1) Pour plus de détails, voir *Bulletin de la Classe des Sciences*, 1919, p. 31 à 35, avec 12 pl. (photographies du Palais au lendemain de l'armistice).

est possible de lire ce qu'ils ont écrit et même de le lire avec plaisir. Il y a un bon index, et mon seul regret, c'est que le directeur de cette publication n'ait point songé à faire indiquer pour chaque personnalité les notices déjà parues, soit dans la Biographie nationale, soit dans la Biographie académique. Il eût été facile de le faire très brièvement et cela eût augmenté considérablement la valeur pratique de ce manuel.

L'Académie fut fondée par MARIE-THÉRÈSE en 1772, mais la période de création n'a qu'un intérêt de curiosité. Ce livre se rapporte donc essentiellement au XIX^e siècle ou plus exactement à la période séculaire qui s'achève en ce moment, mais il nous offre un guide excellent pour l'étude de la pensée scientifique en Belgique durant cette période.

G. S.

Mrs. Ingeborg Hammer-Jensen. — *Die älteste Alchemie*, 159 p. (Danish Academy of Sciences.) Copenhagen, 1921.

In the year 1916, there appeared a short report (1), entitled *Deux papyrus à contenu d'ordre chimique* by Mrs. INGEBORG HAMMER-JENSEN, of whom VON LIPPMANN speaks (2) as author of notable philologic works, among others on the Physics of PLATO and on Aristotelian Meteorology.

The reviewer, not having the early paper in hand, yet judges from VON LIPPMANN'S quotations that the present little book is a representation and enlargement of certain rather revolutionary views presented at that time, which may be listed as follows :

1. The author still maintains, against the objections presented in VON LIPPMANN'S paper, that BERTHELOT'S idea, and the commonly accepted belief, that alchemy was practised in the Egyptian temples and by Egyptian priests, is untenable.

2. The decree of DIOCLETIAN, expelling the alchemists from Egypt, could not have been issued.

3. The Leyden papyrus X and the Stockholm papyrus have nothing to do with alchemy.

4. The recipes of the papyri could not have succeeded.

5. The first authentic writers — from ZOSIMOS, onward — show Gnostic and Neoplatonic influence but no trace of Egyptian origin.

The conclusion of the author is that alchemy may be assumed to have begun in, or about, the fifth century of our era and under purely Christian influence.

(1) In the *Bulletin de l'Académie des Sciences de Danemark*, p. 279-302, 1916; *Isis*, IV, 398.

(2) In his review of this paper, in the *Chem. Zeit.*, p. 589, 1917.

Since BERTHELOT published his *Origines de l'Alchimie* in 1885, each fresh contribution to the history of alchemy has brought about a clearer understanding of the whole matter. Especially welcome therefore is this newest addition from one well versed in classical lore

As new light is thrown on the ancient mystery, it is found that some of BERTHELOT's early conceptions need revision, for he was the pioneer hewing his way thru masses of forgotten alchemistic manuscripts in the libraries. But in general his judgment was sound; and the world will not forget, in spite of the diatribes of VON LIPPMANN and his scarcely substantiated claims against BERTHELOT's incompetence, that without the wealth of translations which the great Frenchman has left us we would still be in darkness in regard to this fascinating subject.

It is therefore pleasant to see that both VON LIPPMANN and our author most subtly compliment BERTHELOT by quoting him freely, showing that it is to him our thanks are due for the output of these more recent investigators whose writings we welcome as pregnant additions to the history of alchemy, whether the theses postulated are acceptable or not.

Our author has made a minute study of those alchemistic writings which may be called the first authentic, from ZOSIMOS to STEPHANOS from the fifth to the seventh century; and in these she discovers influences purely Christian. With this conclusion, which BERTHELOT had foretold, we will all be in complete agreement. The statement is that the first writers belonged to the Gnostic sect — that sect whose ideal, the γνῶσις, was the discovery of the chemistry of nature, how all things have been made; to gain the power of the angels by following the method of God, or of nature — but always necessarily on the Gnostic theory that all kinds of matter have resulted from the mixing (1) of the two opposed elements, fire and water (2). « Originally the first elements were fire and water. It is from the joining of fire and water and from their combination, that many metals have been formed, as well as trees and stones (3). » The alchemistic invention of distillation led to the identification of fire with sulphur and water with mercury, which terms were later translated by the Christian monks into body, soul and spirit.

There is perhaps an unconscious assumption on the part of the author of certain attributes, inseparable from the idea of alchemy and essential to it: — its connection with magic and mystery and the element of conscious deception. Since all such attributes are quite

(1) χυμεία, from which the author derives the word chemistry.

(2) v. BERTHELOT, *Collection des Anciens Alchimistes grecs*, III, XVII, 2.

(3) BERTHELOT, *La Chimie au Moyen Age*, t. III, p. 121.

wanting from the Leyden and Stockholm papyri, the latter can have nothing to do with alchemy. And since these elements appear first in a literature which is wholly under Gnostic and Neoplatonic influence, alchemy so conceived and defined shows no Egyptian origin whatever.

It is now only a few years — such a very few years — since the reviewer was called upon to give an estimate of a delightful book by a noted scientist, who actually conceived of the history of alchemy as covering the activities and publications of those « pseudo-chemists » who, in the middle ages and in Western Europe, sought the « pot of gold » at the foot of the ever vanishing rainbow ! In this case, the only error was in the definition of alchemy ; — but a definition which involves centuries of history is certainly worthy of serious consideration.

The question whether the beginning of alchemy should be placed in the xth or the vth century is purely a matter of the definition upon which we may agree. If we conceive of alchemy as a Western European vagary, our history begins with the xth or xivth century ; if we conceive of alchemy as Egyptian but involved in magic and mysticism, directed by a systematic theory of nature, our history dates from (possibly) the vth century. Both conceptions of the oldest alchemy seem inadequate. BERTHELOT has pointed out and von LIPPMANN has shown very clearly that so complex a system as the accomplished union of an art and a theory can not have been suddenly produced. In all such cases, the simplest, which is the art, comes first and upon it, in the course of time, some theory may be constructed ; or with it or to it some theory already formed may be interwoven or adapted.

In order to make this clear, let us restate the accepted sequence of events which led up to that condition which Mrs. HAMMER-JENSEN is stressing.

VON LIPPMANN states that there are specific references to the industry of color-imitation of the noble metals, carried on in the Egyptian temples by employees of the priests, working in shops inaccessible to the laymen. The recipes of the papyri openly confess the purpose of imitation and the most successful of these recipes are recommended as trade-secrets worthy of preservation. The fact that the recipes for metal-coloring occur along with recipes for the older art of dyeing and for mordants and that the very salts used for mordants were successfully used in coloring metals shows the origin of the newer art (1). Such recipes, originally transmitted by word of mouth, from father to son,

(1) *V. Science Monthly*, p. 530, 1918; *Isis*, III, 129.

were later (1) inscribed on styli in the temple work-shops. So far, alchemy existed in its simple form as an art, having no theoretical or scientific background, its literature only a collection of shop-recipes. But as it attracted more and more attention, it was necessary to guard its secrets against the vulgar and there is evidence that a mystic ritual was developed and that a modified system of Platonic philosophy was adopted to defend the art and to transform the naïve process of imitation into one claiming to be transmutation. The metal was the « body » (σῶμα) whose whole character was determined by the « spirit » or « fire » which was the color. The πνεῦμα is the essence or quintessence in comparison with which the metal earth-body counts as nil. This Greek philosophical development probably occurred about the 11th century and the literature which follows, even to the middle ages, shows the recipes of the papyri as the origin of discussion but the philosophy or theory as the cause. Immediately comes DEMOCRITUS placing the recipes for metals and those for dyeing in juxtaposition, as in the Leyden papyrus, but also presenting for the first time argument and defense. The nonsense of magic, philosophy and mysticism had already entered into the art but as yet under no Christian influence. Granted that this system of applied philosophy was developed rather rapidly, we can visualize as its quite natural results events which are said to have happened — the interference of Rome in 293 as soon as the foolish claim of actual transmutation compelled official recognition (2); the destruction of the work-shops; the flight of the artisans, taking with them the *recipes* in which alone they were interested; then in the 14th century, the destruction of the Greek culture; a second dispersion, this time of the philosophers, transmitting to the Alexandrian Christians and (later) to the Syrian and Arabian compilers the *philosophy, magic and mysticism*, in which alone they were interested but with them some of the (mutilated) recipes. Thus began those two drifts which BERTHELOT traces thru one thousand years, on the one hand the shop-recipes, handed on from artisan to artisan by an « underground » system and on the other the great body of manuscripts of theory and poetry, preserved by theologians in the monasteries, such as we find in the « Ms. St Marc » and in the *Collection des Anciens Alchimistes grecs* of BERTHELOT.

(1) BERTHELOT, *Collection II* (1); and *Les Origines*, p. 29, note 2.

(2) BERTHELOT in *Les Origines*, p. 14, has quoted, from the Roman law, passages which indicate that the decree of DIOCLETIAN was to have been expected, being in accord with regular Roman practice. Our author's contention is that since there were no alchemists before the 7th century, a decree aimed at the Egyptians « who practised this art » would have no significance.

This short statement of the development of alchemy from the simple art serves to orient that particular period in which Mrs. HAMMER-JENSEN is interested and on which she is an authority — the Gnostic and Neoplatonic Christian period, which so stamped the literature of the succeeding centuries that one is tempted to exclaim with our author: Here true alchemy began !

* * *

Let us now consider the claim that the recipes of the papyri (for making copper look like silver or gold, by bronzing with salt, alum, vinegar &c, if the copper is alloyed with a small portion of a noble metal) could never have succeeded and that therefore these recipes have nothing to do with alchemy. The artizans sought a product as like as possible to silver and gold while the alchemists (Gnostics) sought by the help of God to change common stuff into nobler matter.

The reviewer must strongly dissent from the statement that the recipes could never have produced a silver or gold color upon copper or silver previously alloyed with gold. A direct answer to this question may be found in the practice and recipes of the modern bronzer. HJØRNS (1) states (2) that there « is no other metal which by the agency of its own compounds can be so variously and easily coloured as copper ». He then shows that by simple heating with iron oxide, made into a paste of the thickness of cream (3), copper may be colored a deep gold ; and that a copper-tin alloy, heated with vinegar and sal ammoniac, by many repetitions (4), produces a yellow bronze (5) ; and that brass dipped in vinegar and heated gives a golden yellow ; and that these bronze colors are permanent if the work is lacquered (6).

Recipe 89 of the Leyden papyrus has to do with the preparation of « Sulphur water », calcium sulphide. HJØRNS uses a similar reagent :

« The following is a most valuable solution for colouring silver goods

Barium sulphide	5 grains
Water	5 fluid ounces.

This solution imparts a beautiful golden tint to silver when worked cold... passing thru crimson to purple... more or less iridescent ».

The last expression calls to mind the noted sequence of colors occur-

(1) *Metal Colouring and Bronzing*, The MACMILLAN Co. 1907

(2) As the result of his own many experiments. It would seem that some of his recipes are identical or nearly so with those of the papyri

(3) Compare the Greek of the papyrus : « of the thickness of glue ».

(4) Compare the Greek of the papyrus : « and do this many times ».

(5) Compare recipes 15, 20 and 69 of the Leyden papyrus.

(6) Again recall the frequent repetition of the Greek χρῶσις.

ring in all the alchemistic writings: — black, white, yellow and violet (1), the latter being the acme of color, supposed endowed with the power of transmuting color *ἐχρίον* and possibly to be identified with the Philosophers' stone. That this violet was frequently obtained in iridescent form is confirmed by comparison with the modern recipes and by the frequent allusions in the ancient texts to a colour « like the rainbow » or « like the peacock's tail ». HJØRNS shows that copper alloyed with a small portion of gold (2) and dipped into a mixture of verdigris, blue vitriol, nitre, salt, sulphur-water and vinegar, gives a purple, and that this color is increased by holding over a charcoal fire, in true alchemistic fashion.

PELAGIOS states, as quoted in *Die Aelteste Alchemie*, p. 138, that all transmutation was to the alchemist a production of color. If the converse of this proposition is also true, it would seem that there must have been a still older alchemy before the time of ZOSIMOS.

* * *

In reviewing the argumentative portion of this book, it may be safely said that our author has discovered and proven that certain characteristics of the modern form of alchemy may be traced directly to Gnosticism; and in the enthusiasm of this discovery, she has been led to ignore certain primary tendencies which led (1st) to the fusion of the primitive art with Greek philosophy and (2nd) to the adoption of this pseudo-scientific syncretism by the Gnostics; and by ignoring these, she is compelled to ask us to reject much which seems quite probable if not certainly true.

Her first authority, ZOSIMOS, shows on every page his dependence upon « The Philosopher » and other predecessors, while he attempts in a vague manner to explain philosophically what is to him already a « lost art ». Characteristic is such an expression as: « Let us again introduce the ancients. They say that cinabar causes the whitening of magnesia » (*Collection*, III, XXVII, 1.)

There is great need of a clear statement of the history of the sequence of events which led up to the union of Gnosticism with that colouring of metals or transmutation of metals which surely existed before the time of ZOSIMOS. Would that Mrs. HAMMER-JENSEN might, with her eminent fitness for this subject, extend her studies to this earlier field!

* * *

The most notable contribution of this book is the author's estimate

(1) μελάνωσις, λεύκωσις, ξάνθωσις, ιώσις.

(2) The *μάζα* of the papyri.

of the writers, ZOSIMOS, OLYMPIODOR and STEPHANOS, the most prominent of those who tried to revive, or perhaps only to recall to their contemporaries, the art and teachings of alchemy, already forgotten, in that period from the fifth to the seventh century. This has involved studying with care that most forbidding portion of BERTHELOT'S *Collection des Anciens Alchimistes grecs* as well as portions of *La Chimie au Moyen Age* where most of us have feared to tread, with the result that her explanations are most enlightening.

There are two fragments, under the name of ZOSIMOS, so dissimilar that it has seemed that no one man could have fathered both. This mystery is thus explained: — ZOSIMOS, when a young man and Gnostic theologian, found something in alchemy which so profoundly captivated him by its mystery and poetry that in his youthful exuberance he produced the weird allegories or « Vision of ZOSIMOS », full of the fire and imagination of the convert to a new religion (1).

Again we find ZOSIMOS, grown wiser in his later years, the more mature philosopher but eager writer still, producing an extensive work of many parts, of which we have only the final portion, marked « Ω » (2). In this portion occurs a letter, addressed to the noble lady THEOSEBIA, probably in Constantinople, who having been inspired to an interest in alchemy persisted in her devotion after ZOSIMOS, with his eyes open to the growing charlatanism, of which he warns her, had lost faith in the whole matter.

Of the discussion concerning the *καίρικαι* passage it is impossible to speak within the limits of a review. With the text so mutilated and the readings so numerous (3), one can only admire the courage of the author in attempting an interpretation.

OLYMPIODOR, the next historic character, is identified with the known Neoplatonic writer of the same name. It is explained that his letter (4) is evidently addressed to one in authority, probably the emperor JUSTINIAN, who had sought information from OLYMPIODOR in regard to alchemistic methods for the manufacture of gold. The philosopher was however of so late a date and so far removed in point of time from actual alchemy that the emperor could have received no useful knowledge of the art which indeed OLYMPIODOR himself did not understand. Our author fails to call attention to the fact that this was the same emperor who decreed the dispersion of the Neoplatonists. One can not refrain from the thought that possibly the

(1) BERTHELOT, *Collection*, p. 107 ff.

(2) BERTHELOT, *Collection*, p. 228 ff.

(3) *e. g.* *καίρικων*, *κυρικων*, *κερικων*, *κηρικων* and *μερικων*.

(4) BERTHELOT, *Collection*, p. 69-70, pars. 1-48.

character of OLYMPIODOR's letter was sufficient cause for the emperor's indignation.

With the last important writer, STEPHANOS, alchemy is shown to have so far disappeared from the every-day life of man in the viiih century that this writer and so-called alchemist, as Professor of Philosophy at Constantinople, actually delivered his series of *πραξεις* or lectures to students in the University on the philosophical and ethical bearing of alchemy!

This study of the writers of the Gnostic-Neoplatonic period is all quite new and a most valuable exegesis on a section of history heretofore very dimly understood.

The book closes with a few notices on minor authors succeeding STEPHANOS.

(Amherst, Mass.).

A. J. HOPKINS.

Henri Cordier. — *Histoire générale de la Chine et de ses relations avec les pays étrangers depuis les temps les plus anciens jusqu'à la chute de la dynastie mandchoue*, 4 vol., 1863 p. Vol. I-III, 1920; Vol. IV, 1921. Paris, PAUL GEUTHNER. [100 fr.]

Après l'avoir bien longtemps attendue, nous avons enfin entre les mains cette œuvre monumentale qui marque le point culminant d'une longue carrière dévouée tout entière à l'histoire de l'Extrême-Orient. Ces quatre volumes imprimés sous une forme très compacte sont le fruit d'une érudition énorme. Ils nous offrent une histoire de la Chine qui est de beaucoup la plus complète et la plus fidèle que nous ayons et qui sans doute ne sera pas détrônée d'ici longtemps. Il faut avouer toutefois que si ce récit est exact, il manque d'inspiration. Ce n'est pas une œuvre littéraire. Il est bien rare que l'auteur s'enthousiasme ou se déride; il ne nous émeut jamais. A force d'étudier les annalistes chinois, il semble que CORDIER ait contracté leurs habitudes mentales, et ses annales sont à peu près aussi monotones que les leurs. Je ne veux pas dire qu'il soit aussi dénué qu'eux du sens de la perspective. Au contraire, il se rend bien compte de l'importance relative des événements, mais son récit ne met pas suffisamment en relief les faits décisifs. On m'objectera qu'une histoire aussi longue que celle des vingt-deux dynasties chinoises doit nécessairement devenir un peu monotone; il doit s'y trouver bien des répétitions apparentes. Sans doute; et il faudrait avoir l'âme et le talent d'un grand artiste pour peindre cette fresque avec beauté sans compromettre son exactitude. Un écrivain de race aurait mis de la couleur et du relief, — sans aucun délayage. Il aurait su gagner et garder notre attention; il aurait touché notre sensibilité aux endroits pathétiques, — et ceux-ci ne manquent point. Qu'on me

pardonne d'insister là-dessus. Les érudits français, par la haute tenue littéraire de leurs œuvres, nous ont habitué à ces exigences.

Les deux premiers chapitres du volume I sont relatifs à l'étude des origines de la civilisation chinoise et des sources de son histoire. Il est à peine besoin de dire que CORDIER écarte entièrement l'hypothèse de l'origine babylonienne (TERRIEN DE LACOUPERIE; C. J. BALL). S'il est vrai du reste que la Chine nous offre l'exemple de la plus longue tradition nationale, de la plus longue civilisation ininterrompue, il est également vrai que cette civilisation a commencé longtemps après celle de l'Egypte et de la Mésopotamie. — J'ai eu beaucoup de plaisir à lire ce qui suit (I, 38):

Nous avons eu l'habitude d'envisager l'histoire du monde exclusivement au point de vue occidental... Et cependant tel fait qui s'est produit en Europe n'est que le contre-coup d'un événement qui s'est déroulé dans la lointaine Asie... Il est tel règne de l'Empire Chinois qui a plus d'importance pour l'histoire générale du monde que tel autre considéré comme capital à l'autre extrémité du globe... L'histoire du monde forme une unité; si on la considère seulement d'un côté de la planète, si on n'étudie pas sur toute la surface du globe les événements qui s'y déroulent, cette histoire perd ses proportions réelles; on ne perçoit pas la vue de son ensemble, on ne mesure pas exactement les résultats ou le contre-coup de l'action de différents peuples les uns sur les autres... L'histoire se compose non seulement d'une série de faits qui, réunis, coordonnés, constituent l'histoire générale, mais aussi de vastes ensembles qui servent à jalonner les grandes lignes de l'histoire de l'humanité

Ces idées sont précisément celles du Nouvel Humanisme; ce sont elles qui ont inspiré *Isis* dès le début: ce qui nous intéresse, ce n'est point l'histoire de telle ou telle province, mais celle de l'humanité tout entière, l'histoire de l'homme. Malheureusement, CORDIER étant essentiellement un historien politique, il n'a guère développé les pages de l'histoire chinoise qui seraient les plus précieuses pour l'historien de la civilisation. Ainsi les chapitres consacrés à Confucius, à Lao Tseu et aux pèlerins bouddhistes, sont bien maigres. Il consacre quelques pages à la sculpture des Wei, mais ne nous parle guère de l'art des T'ang ou des Soung! Cela paraît assez arbitraire et je ne vois pas d'autre explication que celle-ci: l'auteur a commencé son histoire avec d'admirables intentions, mais bientôt, accablé par sa documentation et sans doute, entraîné par ses propres penchants, il s'est consacré de plus en plus aux faits purement militaires ou politiques, négligeant tout le reste.

La première question que se pose le critique chargé d'examiner une œuvre aussi vaste se rapporte à ses proportions générales. Les voici: les quatre premières dynasties (c'est à dire celles d'avant les Han) occupent 218 p.; les Han, 74; les autres dynasties précédant les

T'ang, 114; les T'ang, 166; les Cinq Dynasties, 56; les Soung, 131; les Youen, 245; les Ming, 89; les Ts'ing, 476; la République, 37. Je ne critiquerai pas l'énorme importance accordée à la dernière dynastie. Cela satisfera sans doute les besoins pratiques de notre temps. Si l'on examine seulement les deux premiers volumes (jusqu'à 1368), ce qui frappe c'est la large place occupée par les Mongols. Cela est dû au fait que c'est à ce moment que le contact entre la Chine et l'Europe a été véritablement et définitivement établi. D'ailleurs les chroniques des missionnaires (1) et des voyageurs étrangers donnent à l'historien une abondance de matériaux intéressants dont CORDIER a su tirer parti (2). Après la dynastie Ming l'auteur a intercalé une sorte d'intermezzo (142 p.) consacré aux découvertes géographiques des xv^e et xvi^e siècles et aux premières entreprises coloniales des Européens en Extrême-Orient. A la fin de chaque dynastie, il nous donne un tableau des règnes et à la fin de l'ouvrage des listes des vingt-deux dynasties, des missions catholiques et des divisions territoriales et un résumé statistique (1919). Il y a un index copieux qui sera d'autant plus utile que ces livres seront plus souvent consultés que lus. C'est bien dommage que CORDIER n'ait pu terminer son livre quelques années avant la guerre, car cela aurait permis une publication moins étriquée. L'éditeur aurait pu y ajouter, par exemple, quelques cartes historiques. La lacune la plus regrettable, toutefois, c'est l'absence presque complète de références bibliographiques; une absence que la publication antérieure de la *Bibliotheca sinica* ne justifie point, car peu de personnes possèdent cet ouvrage. D'ailleurs, ce qu'il aurait fallu ici, ce n'est point une bibliographie complète, mais plutôt à la fin de chaque chapitre ou de chaque dynastie une bibliographie choisie et critique.

Quoi qu'il en soit, l'œuvre de CORDIER est d'une importance fondamentale.

GEORGE SARTON.

Sir Thomas Heath. — *A History of Greek Mathematics*, 2 vol., xv+446 p. xi+586 p. Oxford, Clarendon Press, 1921. [50 sh.]

It seems hardly necessary to speak at great length of a book of which most scholars knew long before it appeared, for few books have been awaited with greater impatience. (It was begun in 1913). Neither is a detailed analysis needed, for the development of Greek mathematics is already on the whole one of the best known parts of the history of science. The student of CANTOR's *Vorlesungen* (third ed. of vol. I, 1907) and of GINO LORIA's excellent manual (*Le scienze esatte nell' antica*

(1) Le mouvement chrétien date du concile de Lyon, 1245.

(2) Il cite *in extenso* de nombreux fragments des chroniques médiévales

Grecia, Milano 1914; *Isis*, I, 714-716) may claim to have already a fair knowledge of the subject. However, Sir THOMAS's account is far more detailed than either CANTOR's or LORIA's, and it is more up-to-date, for we may trust him to have taken full advantage of every fact which has been brought to light within the last years. Sir THOMAS' History will be of very great interest to the mathematician, for apropos of every problem which the Greeks solved or tried to solve, he is never satisfied until the whole process has been carefully explained in modern language. He does not simply state that such or such a mathematician succeeded in proving this or that; he shows elaborately *how* he proved it.

The arrangement of the work is not chronological like LORIA's (at least with regard to geometry); it is mainly according to subjects. The author's reasons will best be explained in his own words :

Take the case of a famous problem which plays a great part in the history of Greek geometry, the doubling of the cube, or its equivalent, the finding of two mean proportionals in continued proportion between two given straight lines. Under a chronological arrangement this problem comes up afresh on the occasion of each new solution. Now it is obvious that, if all the recorded solutions are collected together, it is much easier to see the relations, amounting in some cases to substantial identity, between them, and to get a comprehensive view of the history of the problem. I have therefore dealt with this problem in a separate section of the chapter devoted to « Special Problems », and I have followed the same course with the other famous problems of squaring the circle and trisecting any angle.

Similar considerations arise with regard to certain well-defined subjects such as conic sections. It would be inconvenient to interrupt the account of MENAECHEMUS's solution of the problem of the two mean proportionals in order to consider the way in which he may have discovered the conic sections and their fundamental properties. It seems to me much better to give the complete story of the origin and development of the geometry of the conic sections in one place, and this has been done in the chapter on conic sections associated with the name of APOLLONIUS of Perga. Similarly a chapter has been devoted to algebra (in connexion with DIOPHANTUS) and another to trigonometry (under HIPPARCHUS, MENELAUS and PTOLÉMY).

At the same time the outstanding personalities of EUCLID and ARCHIMEDES demand chapters to themselves. EUCLID, the author of the incomparable *Elements*, wrote on almost all the other branches of mathematics known in his day. ARCHIMEDES's work, all original and set forth in treatises which are models of scientific exposition, perfect in form and style, was even wider in its range of subjects. The imperishable and unique monuments of the genius of these two men must be detached from their surroundings and seen as a whole if we would appreciate to the full the preeminent place which they occupy, and will hold for all time, in the history of science.

The first volume takes us down to EUCLID in the following order : I. Introduction; II. Greek numerical notation and arithmetical operations; III. Pythagorean arithmetic; IV. Earliest Greek geometry. THALES; V. Pythagorean geometry; VI. Progress in the elements down to PLATO's time; VII. Special problems; VIII. ZENO; IX. PLATO; X. From PLATO to EUCLID; XI. EUCLID (p. 354-446). The second volume then proceeds as follows : XII. ARISTARCHUS; XIII. ARCHIMEDES (p. 16-109; XIV. Conic sections. APOLLONIUS (p. 110-196); XV. The successors of the great geometers (NICOMEDES, DIOCLES, PERSEUS, ZENODORUS, HYP-SICLES, DIONYSODORUS, POSIDONIUS, GEMINUS); XVI. Some handbooks (CLEOMEDES, NICOMACHUS, THEON OF SMYRNA); XVII. Trigonometry. HIPPARCHUS, MENELAUS, PTOLEMY; XVIII. Mensuration. HERON OF ALEXANDRIA (Sir THOMAS places him in the third cent. and perhaps little, if anything, earlier than PAPPUS. HEIBERG accepts this conclusion); XIX. PAPPUS (p. 355-439); XX. Algebra. DIOPHANTUS (p. 440-517; XXI. Commentators and Byzantines : SERENUS, THEON OF ALEXANDRIA, HYPATIA, PORPHYRY, IAMBlichUS, PROCLUS, MARINUS OF NEAPOLIS, DOMINUS OF LARISSA, SIMPLICIUS, EUTOCIUS, ANTHEMIUS OF TRALLES, the papyrus of Akhmim, Geodaesia of « HERON the Younger », MICHAEL PSELLUS, GEORGIUS PACHYMERES, MAXIMUS PLANODES, MANUEL MOSCHOPoulos, NICOLAS RHABDAS, IONNAS PEDIASIMUS, BARLAAM, ISAAC ARGYRUS (one sees that Sir THOMAS deals with far more Byzantine mathematicians than LORIA did, but the account is exceedingly brief, — 37 p. for all of them — and more in the nature of an appendix than of an integral part of the work). A regular appendix explains ARCHIMEDES's proof of the subtangent property of a spiral. A Greek index will prove very useful to the student of ancient mathematics.

It would be hardly fair to compare this work with the previous ones by CANTOR and LORIA. Sir THOMAS is easily « *primus inter pares* », but chiefly because he is the latest and also because his account is far more extensive. His superiority over them is not that of genius, but rather that of posteriority and of patience. One cannot too much admire the zeal and the persistency with which he has devoted all the leisure time of a very busy life to this noble hobby, Greek mathematics, and his History is the splendid but natural culmination of almost forty years of study. The perfect clearness of the exposition, its excellent order, its thoroughness lift Sir THOMAS's work above the previous ones. On the other hand, if one would consider them from a broader point of view than the purely technical, it would be clear that this latest history does not completely supersede the Greek chapters of CANTOR's *Vorlesungen*. For Sir THOMAS is not a humanist in the same sense as CANTOR was; his vision is more precise but it is also more narrow; he never quits the ground; even when he has to deal with such tremendous

personalities as EUCLID and ARCHIMEDES he never finds the few simple words which would transform his honest and commonplace style and put it at once on the same level as its subject. This History is irreproachable but it is as cold as a blue book. However, when the imperative needs of accuracy, completeness and clearness are satisfied, it would seem ungenerous to bewail the lack of style, the lack of enthusiasm, the lack of grace.

GEORGE SARTON.

Arthur Berriedale Keith. — *Indian logic and atomism.* An exposition of the Nyāya and Vaiṣeṣika systems. In-8°, 291 p. Oxford, Clarendon Press, 1921.

La question des origines et de l'interprétation de la logique indienne mérite d'intéresser, par-delà le cercle des spécialistes, les historiens de la science. Cette logique, dont l'extension à l'Extrême-Orient est imputable à la propagande bouddhique, ne s'imposa pas moins aux principales civilisations de l'Asie que celle d'ARISTOTE à la culture européenne. Sa formation résulta de la collaboration, ainsi que de la rivalité de divers facteurs : deux écoles brahmaniques, le Nyāya et le Vaiṣeṣika, et deux disciplines hétérodoxes, le Jainisme et le Bouddhisme. Dans chacune de ces traditions spéculatives apparurent, aux IV^e et V^e siècles, des systèmes de pensée logique dont la concurrence incita les défenseurs à préciser les postulats distincts, mais dont, à mesure que les siècles s'écoulèrent, les antagonismes s'émoussèrent en un syncrétisme. La forme éclectique et scolastique de la doctrine, c'est le Nyāya-Vaiṣeṣika, qui s'enseigne aujourd'hui encore dans les écoles indigènes, et qu'a décrit dans son détail le savant collaborateur d'*Isis*, LUIGI SUALI (*Introduzione allo studio della filosofia indiana*, Pavia, MATTEI, 1913). Mais quant aux sources de cette doctrine, en face d'un JACOBI ou d'un SUALI, enclins à tenir pour essentielles les origines brahmaniques, se dresse la thèse de STCHERBATSKY (*Muséon*, V et VI : surtout *L'Epistémologie et la Logique chez les Bouddhistes ultérieurs*, part. II, Petrograd, 1909, ouvrage dont la traduction française, préparée par M^{me} DE MANZIARLY et nous-même, doit paraître dans la série des publications du Musée Guimet), aux yeux duquel les origines bouddhiques sont antérieures et déterminantes.

A. B. KEITH, l'éminent sanscritiste d'Edimbourg, vient de réussir, dans un livre à la fois succinet et complet, à démêler l'écheveau des origines de la logique indienne. Il lui a suffi, pour cela, comme naguère pour élucider la philosophie Sāṃkhya, d'étudier la doctrine à la lumière de l'histoire, en précisant l'apport de chacun des facteurs constitutifs et en marquant avec un soin jaloux les étapes successives de la doctrine. Les sūtras du Nyāya et du Vaiṣeṣika, qui renferment

des principes réalistes, existaient dès le IV^e siècle, à l'époque où ASANGA et VASUBANDHU fondèrent l'idéalisme bouddhique, aussitôt transposé en logique par DIGNĀGA (vers 400) : la théorie bouddhique dont — si l'on met à part les remaniements de texte — ils apportent la réfutation, doit donc être, en dépit de l'opinion de STCHERBATSKY, non pas l'idéalisme yogācāra, mais le nihilisme des Mādhyamikas, antérieur d'un siècle. La logique brahmanique ne semble donc pas postérieure à la logique bouddhique; et l'auteur montre qu'elle tire de la vieille exégèse mīmāṃsiste, inspiration foncière de la tradition védico-brahmanique, l'une de ses sources, celle qui devait alimenter le Nyāya. Ajoutons que cette analyse historique se garde bien de méconnaître d'autres facteurs moins rigoureusement datés, mais non moins certains : telles les méthodes jainas, telle surtout cette sophistique diffuse au sein de laquelle s'élaborèrent dogmes et systèmes, telle aussi l'action plus ou moins indirecte exercée sur la pensée de l'Inde par la logique grecque.

La friction constante entre une dialectique réaliste et une dialectique idéaliste, voilà donc en résumé l'histoire de la logique indienne. Le nerf du raisonnement, c'est, dans le Nyāya de GAUTAMA et de VĀTSYĀYANA, l'énumération exhaustive de relations réelles; c'est, pour le Vaiṣeṣika de PRAÇAṢTAPĀDA, déjà soumis à l'influence de DIGNĀGA, la concomitance du principe et de la conséquence. Pour les logiciens bouddhistes, DIGNĀGA, puis DHARMAKĪRTI, la connexion nécessaire implique, comme dira KANT, une synthèse *a priori*, que l'esprit impose à l'expérience. Mais le réalisme naiyāyika protesta contre cette épistémologie; il finit par admettre sinon une dialectique du nécessaire, du moins une constatation du générique, donnée dans la perception du concret. Tandis que la logique des Grecs a été dès le début une théorie des universaux (γένη), celle de l'Inde n'est ainsi devenue que finalement une théorie des genres (jāti) : indice peut-être d'une lointaine influence hellénique, longue à s'implanter dans un milieu spéculatif qui concevait la raison tout autrement que SOCRATE, PLATON et ARISTOTE.

KEITH, en fidèle analyste des deux systèmes qui font l'objet propre de son étude, ne se borne pas à l'examen des doctrines logiques : il scrute les ontologies et les formes de théisme qui en sont solidaires. Dans ce domaine son appréciation de l'atomisme vaiṣeṣika ne saurait laisser indifférent l'historien des sciences, qui est désormais en mesure, s'il confronte ce livre avec celui de FADDEGON (*The Vaiṣeṣika System*, Amsterdam, JOH. MÜLLER, 1918) et avec un pénétrant article de JACOBI (*Encycl. of Religions and Ethics*, II, 199, Atomic theory), de juger dans quelle proportion les tendances mécanistes se mêlent encore de conceptions qualitatives dans les diverses modalités de l'atomisme indien.

P. MASSON-OURSSEL (Paris).

G. K. Nariman. — *Iranian influence on Moslem Literature*, translated from the Russian of INOSTRANZEV, with supplementary appendices from Arabic sources. Part. I, in-8°, VIII + 205 p. Bombay, TARAPOREVALA, 1918.

Idem. — *Literary history of Sanskrit Buddhism* (from WINTERNITZ, SYLVAIN LÉVI, HUBER), in-8°, XIII + 383 p. Ibid., 1920.

NARIMAN rend aux Occidentaux comme aux Asiatiques un réel service en offrant à bas prix une traduction anglaise de l'ouvrage d'INOSTRANZEV. Cette publication, enrichie d'appendices par le traducteur, complète dans l'ordre de la littérature et des idées l'œuvre de NÆLDEKE, en contribuant à restituer par les sources d'origine arabe la civilisation iranienne préislamique, de foi zoroastrienne et de langue pehlevie. La tâche de l'avenir sera de confronter avec les documents grecs, syriens, arméniens, indiens, chinois, sérindiens, les données que la littérature indigène postislamique a conservées de l'ancienne Perse; données beaucoup plus importantes, si l'on sait les découvrir, que ne le faisait supposer le préjugé très répandu, imputant aux Arabes l'entière destruction de la civilisation qu'ils avaient trouvée dans l'Iran des Sassanides.

L'*Histoire littéraire du Bouddhisme sanscrit*, par le même auteur, ne s'adresse guère qu'aux Orientaux. Elle compile à leur usage de récents travaux européens : tels la *Geschichte der indischen Literatur* de WINTERNITZ, le *Divyāvadana* de HUBER, nombre de publications ou d'articles de S. LÉVI. La haute culture indigène, souvent si peu ou si mal informée du Bouddhisme, y trouvera des notions précises, susceptibles de dissiper bien des préjugés. Malheureusement ce répertoire de l'indianisme contemporain juxtapose sans critique les avis les plus hétéroclites et introduit beaucoup d'inexactitudes dans les renseignements qu'il fournit. Les termes sanscrits, les noms européens fourmillent d'incorrections.

(Paris.)

P. MASSON-OURSSEL.

Sánchez Pérez, José A., catedrático de matemáticas. — *Biografías de matemáticos árabes que florecieron en España*. Obra premiada con accésit por la real Academia de ciencias exactas, físicas y naturales de Madrid, 164 p., Madrid, ESTANISLAO MAESTRE, 1921.

This must prove a most useful compilation, making a very distinct contribution not only to the history of mathematics but to that of astronomy, astrology and the occult sciences. Professor SÁNCHEZ PÉREZ begins his Prológo with a pious reference to the recent (Sept. 1916) loss of his master ECHEGARAY who, stimulated by the ideas of the Nor-

wegian mathematician ABEL, had wrought a renaissance of Spanish mathematics before he turned to politics and the drama. There follows a slight sketch of the history of mathematics, in the ancient world first, and then in Muslim Spain down to the xvth century. Throughout the biographies SUTER's *Mathematiker u. Astronomen der Araber* and CANTOR's *Vorlesungen* have been constant guides but an immense number of other authorities, Arabic and European, have been used besides. From among these HAMMER-PURGSTALL might well have been omitted; nothing can be taken from him without the most searching verification. The result is a series of outlines closely packed with references and facts. But it is to be hoped that Professor SÁNCHEZ PÉREZ will now go on to trace the development of mathematical ideas and theory which must run through these writers.

D. B. MACDONALD.

Lothrop Stoddard. — *The new World of Islam*, viii+362 p., map. New York, CHARLES SCRIBNER'S SONS, 1921.

This book is intended to arouse the Western world to the great transformation which is taking place in that of Islam. It begins with an historical introduction on the decline and fall of the old Moslem world, and then develops in nine chapters various aspects — religious, cultural, political, economic, social — of the present day evolution. It is thus partly historical, partly descriptive of the contemporary, but rapidly changing, situation, and partly an apprehensive view of the future. The historical part must be called poor, especially when it deals with the history of ideas — the Mu'tazilite movement, for example, is completely misunderstood. But the descriptive part is generally good, being based on skilful use of a wide reading in authorities; the book throughout, it may be said, is based upon « authorities » and not upon independent knowledge. But the exactitude of its view of the immediate present and of the future has suffered under the changes of even the last few months. It is already clear that matters political are not so chaotic as STODDARD suggests. For his book suffers from an over emphasis — perhaps necessary to gain attention — which shows itself even in the map where immense solid green blocks in the deserts of Persia, Arabia and North Africa suggest a population which is by no means there. It may be doubted, too, whether the educated intellectuals whose views STODDARD quotes represent much beyond their own little coteries. The vast masses of Islam would probably tell different, or at least highly modified, tales if they could reach expression. Their basal religious attitudes are certainly unshaken. The strength, therefore, of this book is in its pictures of economic and social changes, especially as these affect the externals

of life. That the Western world, and above all the United States, needs arousing to these changes and to the dangers which lie in them is unquestionable, and the book is, therefore, to be welcomed. As an in any way permanent contribution to the history of civilization it is negligible.

D. B. MACDONALD.

De Lacy O'Leary D. D. (Lecturer in Aramaic and Syriac, Bristol University). — *Arabic thought and its place in History*, viii+320 p. London, KEGAN PAUL, TRENCH, TRUBNER, 1922.

The object of this book is to « trace the transmission of Hellenistic thought through the medium of Muslim philosophers and Jewish thinkers who lived in Muslim surroundings, to show how this thought, modified as it passed through a period of development in the Muslim community and itself modifying Islamic ideas, was brought to bear on the culture of mediæval Latin Christendom. » This is very well put and the further thesis of the book is equally to the point. It shows that while the substance of the Muslim culture was the same as that which had developed in the earlier Latin scholasticism — having had the same source — its form had been greatly modified by its centuries of life apart under other influences, and that it was thus fitted to act as a new and stimulating ferment in the intellectual life of Christendom. In doing so it directed, says Dr. O'LEARY, European philosophy into new lines, disintegrated the traditional theology of the Church and directly led up to the Renaissance. But these last points of influence are put too strongly. It was the translation of the Pseudo-DIONYSIUS by SCORUS ERIGENA in 850 which began the long contest of idealism in Europe, and it was direct contact with Greek thought which brought the Renaissance, making Europe again look straight at the facts of life. Muslim culture was scholastic to the end and never reached such direct facing of reality. But the effect of Muslim theology on the theology of the Church has not even yet been fully appreciated. AQUINAS, indirectly and unwittingly, sat at the feet of AL-GHAZZALI.

With such an object the book could hardly fail to be of suggestion and interest. And as such it can be recommended to those who can read it lightly without giving too much credence to particular statements. For it is plain that Dr. O'LEARY's equipment for his task is very unequal. Syriac literature and the authorities to be found there he knows at first hand and he refers to them easily and exactly. The authorities for mediæval and renaissance Europe he knows also: they are open to every one who can read Latin. But there is no sign of first hand acquaintance with the authorities on the Arabic side; it is not even made plain what especial guides he has followed in compiling his

statements, and the occasional references given are sometimes quite blind; the present reviewer is thus cited as simply « MACDONALD », with no book or page. This may be flattering to the « authority »; but it is not helpful to the student. There are far too many misprints, also, and irregularities in names and technical words, and there is no index, or bibliography. Twenty-four pages are expended on a very useless chronological table from A. H. 11-667, giving, year by year, the equivalence A. H. and A. D. and the dates A. D. at which each year A. H. began. If the great blanks under « leading events » had been filled out this table might have been useful.

Dr. O'LEARY had a good idea but has failed to carry it to a successful issue through lack of Arabic knowledge; he has also been exasperatingly careless in matters of form and accuracy.

D. B. MACDONALD.

Louis Bréhier (professeur à l'Université de Clermont). — *L'art chrétien*. Son développement iconographique des origines à nos jours, 456 p., 233 gravures. Paris, H. LAURENS, 1918.

Quelques esprits étroits m'ont reproché d'inclure dans *Isis* des comptes rendus d'ouvrages ne concernant nos études que d'une manière tout à fait indirecte. Pourquoi une revue d'histoire de la science rendrait-elle compte de livres consacrés à la philosophie hindoue ou à la musique japonaise? Pourquoi? Parce que le développement de la science n'est pas indépendant de celui des autres fonctions sociales. C'est en partie pour démontrer cette thèse, pour montrer que l'activité scientifique n'est qu'une des faces de notre vie (la plus merveilleuse sans doute, mais non pas la seule) que j'ai fondé *Isis*. Or, cela m'entraîne à faire périodiquement quelques escapades dans des domaines voisins du nôtre. Si je suis coupable, je le suis doublement, car mon but avoué est d'entraîner les lecteurs d'*Isis* à faire l'école buissonnière avec moi! Mais je ne serais vraiment coupable que si ces comptes rendus subsidiaires prenaient trop de place. Le tout se ramène (comme toujours) à une question de mesure. Ma règle de conduite est la suivante: *Isis* doit s'efforcer de rendre compte de tous les ouvrages importants relatifs à l'histoire (et à la philosophie) de la science, mais de plus elle doit signaler, à titre d'exemple, au moins quelques ouvrages relatifs aux domaines voisins de l'activité humaine. Je dois encore indiquer une autre distinction. A mesure qu'une civilisation est plus éloignée de la nôtre (dans le temps ou l'espace), il devient plus nécessaire que nous la considérions aussi complètement que possible, car ce n'est qu'à ce prix que nous comprendrons exactement son aspect scientifique. Ainsi il est à peine besoin d'insister sur le développement musical en Occident

au XIX^e siècle, car si nous avons des oreilles, ce développement nous est familier, mais il est fort utile au contraire d'expliquer la différence essentielle entre la musique japonaise et la musique chinoise (1), car cette différence nous aide mieux qu'aucune autre à saisir les relations entre ces deux peuples. Elle illumine un tas de problèmes qui étaient restés obscurs dans notre esprit; elle y projette tout d'un coup tant de clarté que jamais nous ne pourrions oublier ce qu'elle nous a révélé.

L'histoire de la philosophie, l'histoire de la religion, l'histoire de l'art sont particulièrement importantes, car elles nous permettent de pénétrer jusqu'au substratum d'une civilisation. L'historien de la science qui néglige d'en connaître tout au moins les grandes lignes, nous donne la mesure de sa propre médiocrité. Nous pouvons prédire que ses travaux seront toujours terre à terre, et, quelle que soit leur valeur technique, que leur signification profonde restera négligeable et leur valeur humaine à peu près nulle. L'histoire de l'art est particulièrement utile (du moins pour ceux qui sont capables de la comprendre) parce qu'elle nous donne de la civilisation où elle s'est écoulée une vision synthétique et immédiate. L'art seul accomplit ce miracle. Un torse grec, un paysage chinois, une fresque gothique — chacune de ces petites choses me révèle tout à coup un univers. Je n'ai pas besoin de comprendre, je le *vois* là devant moi : tout ce que je sais de cette époque s'accroche en quelque sorte à l'œuvre d'art, tous les détails sont devenus vivants; mes connaissances sont fusionnées en un tout organique, harmonieux, à la fois plein de précision, de grâce et d'équilibre. C'est une sorte d'incantation. Je serais presque tenté d'ajouter que celui qui n'a pu évoquer cette vision — que celui qui n'est point parvenu à voir toute la Grèce dans un torse de PRAXITÈLE, ou toute la Chine dans un tableau des Soung — celui-là n'a vraiment connu ni l'une ni l'autre. Mais à quoi bon insister? A quoi bon faire de la peine à ceux qui ne voient pas, à ceux qui ne me comprennent pas et ne me comprendront jamais?

Le livre de BRÉHIER n'est pas consacré à l'art proprement dit, mais à l'iconographie, c'est à dire à l'examen des œuvres d'art du point de vue archéologique; toutefois il n'est pas possible de le parcourir, si l'on a l'âme tant soit peu artiste, sans réveiller à chaque pas des images immortelles. D'ailleurs le mot archéologie ne doit pas être pris dans un sens trop matériel. La portée de l'iconographie dépasse dans une certaine mesure celle de l'histoire de l'art, car c'est grâce à elle que nous pouvons étudier avec précision le progrès de la pensée et du sentiment religieux. Je le recommande de tout cœur à ceux qui étudient la science médiévale. En vérité, ils doivent le lire, mais je leur impose

(1) *Isis*, IV, 77-81.

ainsi une tâche bien agréable. J'y insiste d'autant plus que ceux qui s'intéressent à l'évolution des idées scientifiques au moyen âge, ne sont que trop portés à chercher les éléments d'une vue synthétique dans une direction toute différente, celle de la philosophie. Bien entendu, il leur faut étudier la philosophie médiévale, mais il y a du danger à s'y attarder trop longtemps. L'exemple de ce pauvre DUNEM est assez significatif. Malgré son immense érudition, il est clair qu'il s'est souvent perdu dans le maquis de la scolastique, et à force de s'y promener, d'y tourner en cercle, de s'y égarer il n'a abouti qu'à nous donner cet ouvrage monstrueux *Le Système du Monde*. Plût à Dieu qu'au lieu de s'attarder à fendre des cheveux en quatre dans la compagnie de ces vieux écolâtres, il se fût agenouillé plus souvent devant les tableaux des grands peintres chrétiens...

J'en ai dit assez sur la portée générale de l'œuvre de BRÉHIER. Il est bon d'en indiquer maintenant la méthode et le plan. L'iconographie chrétienne est divisée par l'auteur en six grandes périodes : 1^o Période des origines. L'art chrétien a un caractère surtout symbolique ; 2^o Du IV^e au VI^e siècle. Art triomphal et apologétique ; 3^o Du VI^e au XV^e siècle en Orient. Art byzantin. « La doctrine de l'Eglise grecque qui s'est fixée après la querelle des images, envisage l'ornementation de l'église comme une commémoration de la liturgie. L'art religieux a donc en Orient un caractère presque sacramentel et miraculeux ; il est un des moyens par lesquels l'homme peut s'élever à la contemplation du monde intelligible » ; 4^o Du VII^e au XIV^e siècle en Occident. Art encyclopédique. Cette période qui nous intéresse tout particulièrement est longuement traitée ; cinq chapitres y sont consacrés (p. 167-307). Cet art culmine dans les grandioses encyclopédies de pierre que sont les cathédrales ; 5^o Du XIII^e au XVI^e siècle, se développe en opposition à l'art encyclopédique, un art plus mystique et individualiste. « L'art cherche moins à instruire qu'à émouvoir par le développement qu'il donne aux épisodes les plus douloureux de la Passion ou à plaire par la recherche des détails pittoresques dont il doit une partie à la mise en scène des mystères » ; 6^o Période moderne. « Il y a encore des artistes chrétiens, il n'y a plus d'art chrétien » (MALE). — Les sources littéraires de cet art sont avant tout la Bible, les Actes des martyrs et les Vies des saints, mais aussi une série d'évangiles apocryphes (le bœuf et l'âne de la crèche, par exemple, leur sont dus), et le *Physiologus*.

Il serait vain de vouloir analyser davantage cet ouvrage encyclopédique ; j'y renvoie le lecteur. Mais il est bon cependant d'indiquer qu'au delà de la division en six périodes qui a fourni à BRÉHIER le plan de son livre, il nous fait apercevoir une division plus simple en deux grandes tendances opposées qui traversent toute l'histoire : d'une part la tendance symbolique, pédagogique, abstraite ; d'autre part, la ten-

dance pittoresque, historique, dramatique. « On peut dire que la lutte entre ces deux tendances, la prédominance de l'une ou de l'autre, les tentatives de conciliation entre elles forment toute l'histoire de l'art chrétien ». La première est née dans le milieu hellénistique d'Alexandrie. Après la victoire du christianisme au iv^e siècle, elle s'amplifia et produisit graduellement toute une théologie figurée. Les deux plus grandes écoles artistiques du moyen âge en sont sorties : L'art impérial byzantin du vi^e au xiii^e siècle et l'art gothique du xiii^e. La deuxième tendance prit naissance en Syrie au iv^e siècle. Elle n'est pas hellénistique, mais nettement orientale. « L'hellénisme recule devant le retour aux anciennes conventions de l'art égyptien ou persan. La composition classique rendait la réalité intelligible en résumant pour ainsi dire dans un épisode essentiel toute la succession des faits : la composition orientale cherche au contraire à reproduire cette succession avec une naïveté scrupuleuse, en montrant dans un seul tableau les divers moments d'une même action ». Il est intéressant de suivre avec l'auteur les conflits, les mélanges, les compromis de ces deux tendances si fondamentalement opposées et cependant si voisines dans l'âme humaine. C'est d'ailleurs une histoire extrêmement tragique, car si l'on s'en tient à l'évolution fondamentale, que se passa-t-il ? La scolastique, qui portait en elle des germes mortels, entraîna dans sa chute l'art symbolique et encyclopédique. « Le réalisme mystique triompha dans toute l'Europe ; c'est lui qui inspire en même temps l'école byzantine de Mistra et nos primitifs occidentaux ». Mais à son tour le triomphe des tendances réalistes et individualistes amena inévitablement la destruction de l'art chrétien.

La préface (p. 4-10) contient une intéressante esquisse de l'histoire de l'iconographie chrétienne. C'est à la découverte des catacombes à Rome, en 1578, qu'on doit la naissance de cette branche de l'archéologie. La première étude scientifique de cette question est due à un Belge, JEAN L'HEUREUX (MACARIUS, mort à Rome en 1614 ; son *Hagioglypta* ne fut publiée qu'en 1856). Cet exemple fut bientôt suivi par BOSIO, REISKE, CIAMPANI, JEAN NICOLAI, GAIGNIÈRES, mais au xviii^e siècle le progrès archéologique est interrompu par l'abus des interprétations philosophiques. Le mouvement romantique au contraire exerça une influence bienfaisante, — surtout le *Génie du Christianisme* de CHATEAUBRIAND, 1802. La première œuvre d'ensemble sur l'iconographie chrétienne est celle de DIDRON (1806-1867), le fondateur des *Annales archéologiques*, 1844. Parmi les auteurs contemporains il suffira de rappeler les noms de EMILE MALE, BAYET, DIEHL, DALTON, STRZYGOWSKI.

Le livre de BRÉHIER est solidement documenté, il a été longuement pensé, il est bien écrit sans redondance, sans pédantisme. Les sources

sont indiquées brièvement au bas des pages; les illustrations sont abondantes; il y a d'excellents index. C'est un bon livre.

GEORGE SARTON.

Achalme. — *L'Atome, sa structure, sa forme*, 244 p. (225×140), 15 pl., 63 dessins à la plume. Paris, PAYOT ET C^{ie}, 1921. [15 fr.]

Il est de mode aujourd'hui de se lamenter sur la spécialisation des savants qui, ne voyant plus qu'un fragment, toujours le même, du champ au milieu duquel se déploie l'activité humaine, arrivent à en faire le centre du monde et restent fermés à tout ce qui n'est pas du domaine de leur activité propre. Il y a là d'ailleurs beaucoup d'exagération et l'on ne voit pas du tout comment pourrait monter toujours plus haut, s'étendre toujours plus avant l'édifice scientifique, si les savants ne se spécialisaient point.

Quoi qu'il en soit, à côté de ces spécialistes il est d'autres savants qui voient loin, qui voient grand, sont épris de synthèse et ne craignent pas, partant même d'un point de vue particulier, de dresser d'immenses édifices dans le champ libre où quelques pierres seulement jalonnent les voies dans lesquelles il est possible de s'engager sans trop risquer de s'égarer. Si parfois ils font fausse route, leurs constructions sont néanmoins intéressantes, lors même qu'elles s'écroulent; d'autres esprits utilisent à nouveau quelques-uns de leurs matériaux et procèdent à l'érection d'édifices de plus en plus solides.

De ces esprits qui voient grand, que n'effraient pas les projets de constructions audacieuses, fait certes partie ACHALME, directeur de laboratoire à l'École des Hautes-Études, qui cherche à pénétrer la structure intime du monde extérieur et d'en donner une représentation concrète permettant une explication rationnelle des phénomènes chimiques et biologiques. Les résultats de sa construction, car c'est d'une véritable construction qu'il s'agit ici, seront donnés dans un ensemble de sept volumes groupés sous l'étiquette commune : *Les Édifices physico-chimiques* et dont le premier seulement est paru, traitant de l'atome, de sa forme, de sa structure. Les six volumes suivants nous donneront les conceptions de l'auteur sur la molécule chimique en général, la molécule minérale, la molécule organique, la molécule vivante, les êtres vivants et enfin l'homme.

Dans son travail sur l'atome, ACHALME, partant de l'idée en général admise aujourd'hui que les corps matériels sont constitués par la réunion d'électrons n'ayant qu'une masse électro-magnétique et d'unités matérielles qui peuvent se ramener à l'atome d'hydrogène dont une des propriétés est l'électricité positive, que le poids atomique d'un élément exprime dès lors le nombre d'unités de matière entrant dans la consti-

tution de l'élément et que la valence représente le nombre d'unités de matière qui ne sont pas neutralisées par des électrons interatomiques, arrive à donner au carbone par exemple, non plus seulement le symbole $C = 12$, mais celui-ci : $C = 12 U. M + 4 E$ (12 unités de matière + 4 électrons interatomiques) et il tente de donner une représentation matérielle de l'édifice atomique relatif à *chaque* élément, domaine dans lequel il est évidemment impossible de le suivre dans cette courte analyse.

Le chapitre purement constructif est précédé d'un rappel critique, en un langage particulièrement clair, des recherches récentes qu'il est indispensable de connaître pour suivre l'auteur dans sa tentative.

Evidemment, un travail de ce genre ne peut prétendre fixer définitivement les connaissances relatives à l'atome et, en particulier, les belles recherches d'ASTON sur les corps isotopes modifieront quelques-unes des données dont ACHALME fait état, mais elles n'infirmen cependant en rien la construction qu'il donne, par exemple, de l'atome d'iode pour lequel il admet un isotope, tandis que pour ASTON (juillet 1921), cet élément n'en comporterait pas. Et quel que soit le sort que l'avenir réserve aux spéculations hardies du savant dont on connaissait déjà l'esprit synthétique depuis la publication, en 1913, d'un gros volume *Electronique et Biologie* — elles seront sans doute peu goûtées des chimistes, parce que n'ayant pas pour eux une portée utile immédiate — il y faudra reconnaître un travail puissant dont maints éléments seront sans doute à nouveau utilisés, si l'avenir ne montre pas la stabilité de l'ensemble de sa construction.

L. GUINET.

G. Urbain. — *Les Disciplines d'une Science : la Chimie*, 325 p. (185 × 120).
Paris, GASTON DOIN, 1921. [10 fr.]

L'*Encyclopédie scientifique* que publie l'éditeur DOIN, sous la direction du Dr TOULOUSE, directeur de l'École des Hautes-Études et qui ne comporte pas moins de quarante sections devant comprendre, d'après la notice de l'éditeur, un millier de volumes, dont a paru un nombre assez élevé déjà (environ 200, dont certains ont eu plusieurs éditions ou réimpressions) sont écrits par des savants pour des savants, s'enrichit d'une nouvelle section dite : Bibliothèque d'histoire et de philosophie des sciences, et dirigée par A. REY, professeur d'Histoire de la philosophie dans ses rapports avec les sciences, à la Sorbonne. Le premier volume de cette section nouvelle vient de paraître, dû à la pensée d'un des plus autorisés parmi les chimistes français, d'un savant qui, bien que spécialisé dans un domaine des moins cultivés de la chimie, celui des terres rares, sait s'élever très loin au-dessus du champ de ses recherches de laboratoire et, nourri de la pensée de

CONDILLAC et d'AUGUSTE COMTE, ne craint pas d'embrasser d'un coup d'œil d'ensemble la chimie tout entière, ou plutôt la physico-chimie qui est la science de l'avenir, et nous donne ses vues originales sur la systématisation des propriétés physico-chimiques.

GEORGES URBAIN aime la science qu'il cultive et qu'il enseigne à la Faculté des Sciences de Paris avec un bel enthousiasme, et s'efforce de communiquer aux autres son amour de la science. Mais comme il a eu des désillusions au début de sa carrière de chimiste, voyant la science comme elle n'était pas, mais comme le lui permettait l'époque du scientisme alors triomphant, il essaie, après ses trente années de laboratoire, d'épargner aux autres, les incertitudes et les doutes par lesquels il est passé. La longue Introduction de son livre (38 p) est consacrée à montrer ce qu'est actuellement, du point de vue du savant qui sait se doubler d'un philosophe positiviste, la science, et quel rôle y jouent l'expérimentation et la théorie. Vue telle qu'elle est, la science est encore assez belle pour celui du moins qui, voulant la juger, s'est astreint à la longue préparation nécessaire.

Certains de ses aspects peuvent la faire paraître sèche et rebutante, ils ne sont qu'une bien petite partie de la science et si le savant veut faire œuvre durable, il doit déployer au moins autant d'imagination qu'un artiste ou un poète : « L'œuvre de science, comme l'œuvre d'art, évoque des images. Elle a les mêmes droits à la beauté ».

Cette science, qu'est-elle donc ? URBAIN la définit : « une adaptation de nos moyens intellectuels aux domaines sensibles de l'univers », voulant dire par là que nous pouvons seulement nous familiariser avec les phénomènes, en prédire le retour avec une probabilité plus ou moins grande suivant des lois plus ou moins approximatives. La prévision est la fin réelle de la science et non l'explication ; le savant ne peut en effet que comparer, trouver des analogies ; or, on n'explique pas parce que l'on compare.

Mais la condition essentielle à la prévision du retour des phénomènes, c'est la connaissance des conditions dans lesquelles ils se sont déjà produits. Ces conditions ne sont pas toutes d'importance égale ; les unes peuvent être considérées comme principales : ce sont celles qui seront toujours scientifiquement accessibles ; les autres, les conditions secondaires, ne seront pas nécessairement accessibles à l'expérience, étant donné qu'il y a toujours lieu de faire la part de l'imprévisible ; certes, les progrès constants de la science restreignent de plus en plus cet imprévisible, mais ils n'arriveront sans doute jamais à l'anuler complètement. Il semble donc nécessaire de faire des restrictions sur le déterminisme qui, s'il est une condition suffisante de la science, n'est peut-être pas la loi intransgressible de l'univers : URBAIN se pose, en effet, à propos des expériences de Gouy sur le mouvement brow-

nien, cette question à laquelle nulle réponse n'est actuellement possible : dire que la micelle colloïdale obéit à la loi du hasard, est-ce « faire un aveu d'impuissance à fixer les conditions de ce mouvement », ou bien « mettre en doute le principe souverain du déterminisme universel » ? Ces deux manières de voir sont, en droit, également admissibles.

Comment se fait la science expérimentale ainsi définie ? Le savant multiplie ses observations dans une direction donnée, dresse des diagrammes de plus en plus précis, vise à dégager les lois que peuvent représenter ses figures géométriques et cherche à traduire ses courbes en un langage aussi clair et aussi concis que possible. Mais, entre l'objet observé et les sensations que nous en avons et qui sont les matériaux avec lesquels notre esprit crée des perceptions, interviennent les jugements qui assurent la liaison. Ces jugements, le savant les introduit en nombre aussi petit que possible et c'est là une des caractéristiques de l'esprit scientifique : les chances d'erreur augmentent en effet avec le nombre des jugements.

Les lois particulières étant ainsi établies après observations en nombre le plus élevé possible, l'expérimentation a joué son rôle principal, elle doit momentanément céder la place à la théorie, et n'interviendra plus guère qu'à titre de contrôle. Actuellement, deux théories dominent tout l'ensemble de la chimie, l'une « belle et austère comme la Minerve antique » est l'énergétique, l'autre « pimpante et jolie comme une coquette de WATTEAU » est l'atomisme. Quelle qu'elle soit, la théorie est éminemment commode en ce sens qu'elle coordonne en un ensemble de synthèses économiques les documents que fournit l'analyse expérimentale, et dont le nombre croît d'autant plus rapidement que le nombre des ouvriers de la science spécialisés va sans cesse en augmentant ; elle est donc un moyen de permettre une plus rapide assimilation des connaissances. Elle est aussi source de découvertes nouvelles.

Au reste, atomisme et énergétique ont tous les deux à leur actif d'amples moissons de faits nouveaux de la découverte desquels ils ont ouvert le chemin. Ce sont deux belles routes qui se rencontreront vraisemblablement un jour, et qui, en attendant, desservent des régions différentes ; la chimie des espèces thermodynamiquement stables dans des conditions que nous sommes capables de réaliser est dominée par les principes de l'énergétique, celle des espèces thermodynamiquement instables dans les conditions pratiques de l'expérimentation, donc la chimie des complexes du carbone en particulier, échappe à cette domination et se trouve envahie presque uniquement par les doctrines atomistiques.

Mais ce qui est nécessaire surtout au savant, c'est une discipline intellectuelle et une discipline expérimentale. Ce qui fait par exemple

la grandeur de la réforme de LAVOISIER, du *Discours préliminaire* duquel URBAIN cite plusieurs passages, c'est autant la discipline qu'il a su introduire dans la science, et qu'il a puisée dans la philosophie sensualiste de LOCKE et de CONDILLAC, que le principe de la conservation de la matière, et la substitution de la théorie positive des combustions à la théorie du phlogistique.

Je me suis étendu longuement sur cette Introduction de l'ouvrage de G. URBAIN parce qu'elle me semble une mise au point très exacte des principes directeurs que suivent la plupart, non seulement des chimistes, mais des savants cultivant d'autres disciplines, et que l'on peut faire entrer dans le groupe des « classiques » d'OSTWALD (apud les *Grands Hommes*). ACHALME, duquel j'ai précédemment rendu compte d'un travail sur *Les Atomes*, est au contraire un « romantique » et prend une attitude très différente de celle de URBAIN. Je ne pense pas, pour ma part, que la science doit avoir pour unique objet la découverte des lois ; si la science répond à un besoin naturel de l'esprit humain, c'est que celui-ci cherche précisément l'explication des phénomènes, que se refusent à poursuivre les positivistes.

L'ensemble du travail, dans l'examen duquel je ne puis pas entrer, est ainsi partagé : A) LES CLASSIFICATIONS. (I) *Les origines de la théorie atomique* ; (II) *Les classifications. Eléments ou radicaux* ; (III) *L'Isomorphisme* ; (IV) *Essai de systématisation des propriétés physico-chimiques : l'homéomérie* [Ce chapitre est l'exposé des vues originales auxquelles est arrivé l'auteur, après ses vingt-trois ans de travaux sur les terres rares, la théorie de l'homéomérie, dérivée de l'énergétique, devant englober toutes les lois connues de la chimie et de la physico-chimie.] — B) LES INVARIANTS : (I) *L'énergétique chimique et l'idéal comtien* ; (II) *Deux domaines, deux doctrines* [énergétique et atomisme] ; (III) *Lois rigoureuses* [proportions fixes, nombres proportionnels] ; (IV) *Les généralisations outrancières* [système thermochimique de BERTHELOT, théorie actuelle des solutions] et approximations. — C) LES SYMBOLES. (I) *La constitution des corps* ; (II) *Les principes de la systématique des complexes minéraux parfaits* [travaux de WERNER] ; (III) *Constitution et propriétés physiques*.

L. GUINET.

Edmund O. von Lippmann. — *Zeittafeln zur Geschichte der organischen Chemie*. Ein Versuch., ix + 67 p. Berlin, JULIUS SPRINGER, 1921.

No sooner had Dr. LIPPMANN completed his great work on Alchemy (1) than he began the elaboration of these tables on organic

(1) See *Isis*, III, 302-305.

chemistry, for which he had patiently accumulated material at least since 1905. These tables will be extremely useful, even if one makes allowance for the mistakes which are bound to occur in any such extensive compilation. The data are classified primarily in chronological order, secondarily in the alphabetical order of the modern names of the substances investigated. For the year 1804 we will find *ex. gr.* the following entries :

« Carthamin aus Safflor beob., DUFOUT (A. ch. 48, 283).

« Inulin aus Alantwurzel, ROSE (GEHLEN 3, 217) (1).

« Rhodanwasserstoffsäure aus Cyankalium und Schwefel, RINK (GEHLEN 2, 460). »

The chronological limits of the tables are the years 1500 and 1890, but the author has prefixed a short account of the organic substances which were known in ancient and medieval times (2). The tables have been limited to 1890, because after that date research was organized on such a scale that discoveries increased tremendously in number. Besides, the new BEILSTEIN and other reference books make it relatively easy to obtain information on these latest developments and the majority of chemists now living are more or less familiar with them. The year 1890 is a fitting limit for it was immortalized by two great syntheses, that of glucose by FISCHER and that of indigo by HEUMANN.

An excellent feature of the book is the inclusion of references to EDW. HJELT, *Geschichte der organischen Chemie*, Braunschweig 1916 (3) and to CARL GRAEBE, *Geschichte der organischen Chemie*, Berlin 1920 (4). As these two important books have no subject-indexes, LIPPMAN'S index will be invaluable as a supplement to them, or as a key.

GEORGE SARTON.

Stevenson, Edward Luther. — *Terrestrial and celestial Globes.* Their history and construction including a consideration of their value as aids in the study of geography and astronomy. 2 vol. (Publications of the Hispanic Society of America, No. 86), xxvi + 218 p.; xii + 291 p.; 87 + 143 illustrations. New Haven, Yale University Press, 1921.

Globes, both terrestrial and celestial, have always attracted the attention of a large number of people. It is perhaps not too much to

(1) Den Namen Inulin gab erst 1811 THOMSON.

(2) The xvth and xvth cent. occupy each ab. 1 p., the xvth ab. 7 p.!

(3) See *Isis*, III, 440.

(4) See *Isis*, IV, 361-365.

say that there is in them a certain fascination. To the uneducated, they seem mysterious emblems of science and power, they often appeal by their beauty and many an ignorant collector of books would deem his library incomplete if it were not adorned at least with a pair of them. For the educated scientist, their fascination is not smaller by any means though of a very different nature: he sees in them the clear synthesis, the epitome of a vast amount of knowledge. If he has a little imagination, he cannot examine a globe without realizing at once the immense display of patient research, of indefatigable endeavor, of heroic devotion, and even of suffering and martyrdom of which the fruits are thus offered to him in a most condensed yet intuitive manner. It may seem strange then that an historical survey of these remarkable objects had not yet appeared in English. To be sure many patient investigations have been devoted to them. I need only recall the name of MATTEO FIORINI, professor at the University of Bologna, the master, we might even say the founder, of these studies. His most important memoir on the subject, before 1895, was « *Le sfere cosmografiche e specialmente le sfere terrestri* », which appeared in the *Bollettino della Società geografica italiana*, serie III, vol. VI e VII, Roma 1893-1894 (*passim*). This memoir was translated into German by SIEGMUND GÜNTHER, « *Erd- und Himmelsgloben, ihre Geschichte und Construction. Nach dem Italienischen Fiorinis frei bearbeitet* », München 1895. GÜNTHER had added bibliographical references to the Italian text, also short chapters on globe-gore construction. Later FIORINI published in book-form a more important review of the question: *Sfere terrestri e celesti di autore italiano oppure fatte o conservate in Italia*, xxi + 502 p. Roma 1898. It is obvious that no one could write on globes, after FIORINI, without being deeply indebted to him. STEVENSON proclaims his own gratitude in a very handsome manner (p. xx): « The author makes special mention of his indebtedness to the studies of the distinguished Italian scholar, Prof. FIORINI, adding that with some propriety his name might have a place on the title-page ». This is a great tribute, both to FIORINI's learning and initiative and to STEVENSON's modesty. For if it be true that FIORINI's memoirs (which are by the way far more bulky than the book under review) form the core of STEVENSON's work, it is not less true that the latter has carried on for many years supplementary investigations and has examined many globes hitherto undescribed (1). The Museum of the Hispanic Society (New York) alone furnished him with a remarkable collection of globes, and he managed to collect not less than 400 globe photographs. One of the most attractive features of

(1) More than 850 have been listed by him.

STEVENSON's book is the very rich series of illustrations, which is more than sufficient to give one a very fair idea of all the types of globes constructed before 1800. This will interest the amateurs for whom such globes are primarily objects of ornament. It must be admitted that some of them, especially the early ones, are very beautiful indeed.

The scope and general outline of this work are the same as FIORINI's, but for the addition of a final and very short chapter (24 p.) on the technique of globe construction. Such a chapter was already included in GÜNTHER's translation, which I was not able to examine. Both authors trace the history of globes as far back as the available material permits and stop it somewhat arbitrarily about the year 1800; for the history of modern globes would be also interesting, though from a different point of view, and the heroic age of globe construction was long passed before the end of the xvth century.

The few following facts may be of interest to our readers: the ancients made celestial globes and PROLEMY gives one the impression that they were not uncommon in his day. However, but one example is still extant, the *Atlante Farnese*, a statue of marble bearing a celestial globe, in the Naples Museum, dating from c. 200 B. C. The Muslims constructed many celestial globes (apparently no terrestrial ones) and quite a few have survived. The oldest of these, dating from 473 A. H. (= 1080/1 A. D.), is kept in the R. Istituto di Studi Superiori of Florence. STEVENSON describes others dated respectively 1225, 1275, c. 1279. The next globe in point of time is the earliest Christian and the earliest geographical globe extant, constructed by MARTIN BEHAIM in 1492. It is interesting to note that this treasure still belongs to the BEHAIM family, though it is now deposited in the Germanic museum of Nürnberg. Another fifteenth century globe, constructed by JOHANNES STÖFFLER (1452-1531) is preserved in the Lyceum Library of Constance, Switzerland.

The account covers thus far 58 p. The rest of the first volume is entirely devoted to the xvth century, four chapters dealing with the four successive quarters of this century. The second volume treats the xvth and xvth centuries and ends fittingly with a bibliographical list, an index of globes and globe makers, which will greatly facilitate further research, and a general index.

This book has given me considerable pleasure and I have naught but minor criticisms of it to suggest. As to the form, I think that the legibility and attractiveness would be increased, if the quotations, especially the longer ones, were printed in a different type in separate paragraphs. It would be desirable also to indicate the location and size of each specimen illustrated below the illustration itself, to avoid

constant reference to the index. The problem of globe-gore construction deserves a more elaborate treatment than the author has accorded to it. It would be of great interest to the historian of science to follow in detail the interactions between geography and mathematics and to see to what extent map-projection was affected by the far simpler problem of gore construction. As STEVENSON has devoted much space — and very justly so — both to BEHAIM and to MERCATOR, one is a little surprised to find no reference, apropos of the former, to the controversy raised by BENSAUDE (*Isis* I, 716-718; III, 424-426), and apropos of the latter to the NUÑEZ-MERCATOR or the loxodromic controversy (*Isis*, III, 106; IV, 591). The final pages dealing with orreries are so meager that it would have been better to leave them out. But the author might perhaps be persuaded to give us later a history of these useful instruments? The pedagogical value of globes is indicated but so slightly that the last fifteen words of the title cannot be considered as truthful. The statement that globes and orreries are now hardly used in the American schools is amazing and saddening, for it seems well-nigh impossible to explain the fundamental facts of geography and cosmography to children without them. GEORGE SARTON.

I append a list of Dr STEVENSON's main publications on the history of cartography :

1. MARTIN WALDSEEMÜLLER and the early Lusitano-Germanic cartography of the New World. (*Bulletin of The American Geographical Society*, p. 193-215. New York, 1904.)

2. Comparative fallacies of early New World maps. (*Proceedings of the International Congress of Americanists*, p. 125-133, XVth session. Quebec, 1906.)

3. Maps illustrating early discovery and exploration in America, 1502-1530; reproduced by photography from the original manuscripts. New Brunswick, 1906.

Explanatory text and key maps, 30 p.

Twelve maps on one hundred and twenty-four sheets, each map in the size of the original. In imperial portfolio and one roll. Twenty-eight copies printed.

4. Typical early maps of the New World. (*Bulletin of The American Geographical Society*, p. 202-224, sixteen reproductions of early maps. New York, 1907.)

5. Map of the World by JODOCUS HONDIVS, 1611, with title « Novissima ac exactissima totius orbis terrarum descriptio magna cura et industria ex optimis quibusque tabulis Geographicis et Hydrographicis nuperrimisque doctorum virorum observationibus duobus planisphaerijs delineata Auct. I. HONDIO ». Facsimile of the unique original, measuring 160×246 cm., in the Library of Prince MAX VON WALDBURG ZU WOLFEGG-WALDSEE. Issued jointly with

Prof. JOSEPH FISCHER, S. J. Publication of The Hispanic Society of America, No 36. New York, 1907.

6. Marine World Chart of NICOLÒ DE CANERIO JANUENSIS (ca.) 1502. Facsimile of the unique original, measuring 115×225 cm., in the « Archives du Service Hydrographique de la Marine, Paris », with accompanying critical text. Publication of The Hispanic Society of America, No. 38. New York, 1908.

7. Early Spanish cartography of the New World with special reference to the WOLFENBÜTTEL Spanish Map and the work of DIEGO RIBERO. (*Proceedings of the American Antiquarian Society*, p. 369-419. Worcester, 1909)

8. Atlas of Portolan Charts. Facsimile of an original manuscript belonging to the British Museum (Egerton Ms. 2803), edited with a brief introduction and list of charts. Publication of The Hispanic Society of America, No. 81. New York, 1911.

9. Portolan Charts. their origin and characteristics, with a descriptive list of those belonging to The Hispanic Society of America, 80 p. with fifteen full page chart reproductions. Publication of The Hispanic Society of America, No. 82. New York, 1911.

10. Genoese World Map, 1457. Facsimile of an original parchment manuscript measuring 42×81 cm., in the Biblioteca Nazionale Centrale, Florence, with critical text incorporating in free translation the studies of Prof. THEOBALD FISCHER revised with the addition of copious notes. Publication of The Hispanic Society of America, No. 83. New York, 1912.

11. Maps reproduced as glass transparencies selected to represent the development of mapmaking from the first to the xviii century, 55 p. with four map reproductions. New York, 1913.

12. WILLEM JANSZON BLAEU, 1571-1638. A sketch of his life and work, with an especial reference to his large World Map of 1605 reproduced in facsimile of the unique original, measuring 134×244 cm., in the Library of The Hispanic Society of America. Publication of The Hispanic Society of America, No. 85. New York, 1914.

13. Portolan Atlas signed « JOAN MARTINES en Messina Año 1582 ». Facsimile of an original manuscript atlas belonging to The Hispanic Society of America, with an introduction, including a list of MARTINES' known cartographical productions and bibliographical references. Publication of the Hispanic Society of America, No. 88. New York 1915.

14. Portolan Atlas signed « YHS MA XGO CONTE DE OTTO MASO FREDUCCI de ancona la fatte nel año MCCCCXXX7 ». Facsimile of an original manuscript atlas belonging to The Hispanic Society of America, with an introduction, including a list of FREDUCCI's known cartographical productions and bibliographical references. Publication of The Hispanic Society of America, No. 95. New York, 1915.

15. Portolan Charts Facsimiles. Fifteen reproductions of large single sheet portolan charts from originals in the collection of The Hispanic Society of America. Publication of The Hispanic Society of America, No 104. New York, 1916.

Fielding H. Garrison. — *An introduction to the History of Medicine* (with medical chronology, suggestions for study and bibliographic data). Third edition, revised and enlarged. 942 p., with 257 portraits. Philadelphia, W.-B. SAUNDERS, 1921. [9 dollars.]

GARRISON'S *History* is already so well and so favourably known at least to the English-speaking reader, that it would be superfluous to analyze it at great length. But the reader is naturally anxious to know in what this edition differs from the preceding ones (1) and this question can be best answered by quoting the author's own words : « A careful account has been rendered of the newer findings of SUDHOFF, NEUBURGER, WICKERSHEIMER, SINGER and other European investigators of ancient and medieval medicine; new matter has been added on the doctrine of the origin and transmission of ethnic culture (convergence and convection); on Chinese medicine; on the history of pediatrics, dentistry, public hygiene, military medicine and medical lexicography; on the earlier nuclei of medical education in the United States; on recent Japanese, Spanish and Latin-American medicine; and on the work of the medical departments of armies in the European War. A number of new biographical sketches have been added with portraits of SYMPHORIEN CHAMPIER, VILLEMIN, GURLT, LITTRÉ, SAL-KOWSKI, OSLER, MAX NEUBURGER and others. Errors of omission and commission have been corrected; the bibliographies at the end of the volume have been enlarged and improved; and the author index has been made as complete and exhaustive as possible... »

It is of course out of the question to criticize in detail a book of such amplitude. Even if he tried, the critic might not notice at once the errors which are bound to exist. But it is interesting to examine the general proportions of the work. Now I find that 54 p. are devoted to primitive and Oriental medicine; 39 to Greek and Greco-Roman times; 75 to the medieval period (including Byzantium and Islam); 56 to the Renaissance; 73 to the xviiith cent.; 110 to the xviiith and 394 to the xixth century and after. The most striking fact is the enormous space allotted to modern medicine, half of the book being devoted to the last century. I will not quarrel with the author on this score. As his book is written primarily not for historians but for medical students, it seems reasonable to lay emphasis on the latest developments and to speak chiefly of these men who will be so often quoted to them in their medical lectures. Dr. GARRISON is thus right, I think, in dividing his book into two equal parts : the past and the present, the dividing

(1) The first edition appeared in 1913; it was reprinted in 1914. A revised edition came out in 1917.

line being drawn near the year 1800 A. D. But I can not accept his subdivision of the first half. In particular, the allotment to the middle ages of twice more space than to classical antiquity shocks me to a degree. If one realizes the immensity of our debt to the Greeks, and, on the other hand, how little original knowledge has been handed over to us by the medieval physicians, such treatment is but little short of monstrous ingratitude. It is likely that Dr. GARRISON has been gradually led to assume this criminal attitude by the number of studies which are now devoted to medieval medicine. But the amount of attention paid to a subject is no measure of its real importance. The present popularity of medieval science is easily explained by the fact that it offers to investigators an immense field of research largely unexplored. Thousands of Mss. await readers, and the scholars engaged in transcribing them feel that they are doing useful work : they are preparing new material for the historian of to-morrow. Their activity will make it possible by and by to retrace more exactly the intellectual development of the middle ages, though it is very doubtful whether it will modify in any essential point our general conception of it.

It is a very remarkable fact that, as far as I know, no history of medicine proper has ever been written. I mean that every so-called history of medicine includes so many other elements that it would be more correct perhaps to call it a history of science from the medical point of view. This is especially true of GARRISON's book which is extremely comprehensive : the anatomists, physiologists, chemists and botanists whom one is accustomed to meet in the medical pageant are there all of them and some more, but even that did not satisfy the author, who has thought it necessary to quote also many a physicist and mathematician ! Consider a statement like this, for instance (on p. 424) : « Of modern mathematicians, we need only mention the names of EULER, GAUSS, RIEMANN, JACOBI, ABEL, WEIERSTRASS, CAYLEY, SYLVESTER... » Without stopping to discuss this choice, I wonder what may be the use of such a bare enumeration?

It is interesting to compare GARRISON's history with that published about the same time by MEIER-STEINIG and SUDHOFF (1). I would advise students to use both books, the former chiefly for the modern part, the latter for the past. Not simply the text of these two books but also their illustrations are complementary. The latter is especially interesting for the archaeological illustrations, while Dr. GARRISON has offered his readers a splendid collection of portraits. These portraits, 257 in number, though small are excellent. They

(1) See *Isis*, IV, 368.

alone would give one sufficient reason for buying this very useful volume.

GEORGE SARTON.

Sir William Osler (Bart., M. D., F. R. S.). — *The Evolution of Modern Medicine*, 243 p., New Haven (Yale University Press), 1921.

This volume comprises six lectures delivered at Yale University in April, 1913, as the tenth of the series of SILLIMAN Memorial Lectures. Before the author had completed the reading of the galley proof, the great war came with its inexorable claims on his energy and devotion. FIELDING H. GARRISON, HARVEY CUSHING, EDWARD C. STREETER, and LEONARD L. MACKALL (Savannah, Ga.) have now brought to publication these lectures, which afford a delightful and illuminating survey of the development of medicine from Egyptian and Babylonian times till our own. The volume with its excellent typography, pleasing format, and copious illustrations is a work of art, worthy of the memory of Sir WILLIAM OSLER.

The opening lecture, under the name of Introduction, deals with various phases of oriental medicine, including Hebrew, Chinese and Japanese (ancient). The subsequent lectures deal with Greek medicine, mediæval medicine, the Renaissance, and the rise of anatomy and physiology, the rise and development of modern medicine (from about the middle of the xviii century), and the rise of preventive medicine. OSLER in a letter to one of the editors spoke of these lectures as « an aeroplane flight over the progress of medicine through the ages. » Nevertheless, though the pace is very rapid at times and one may miss the mention of certain great names — like JOHANNES MÜLLER, SCHWANN, and V. BAER — the sketch is eminently satisfying. There is not a dull sentence in the volume, which reflects throughout the author's vivid personality, his zeal in the cause of human welfare, and his faith in the redemptive power of science.

In turning to the consideration of Greek medicine OSLER exclaims : « Let us come out of the murky night of the East, heavy with phantoms, into the bright daylight of the West, into the company of men whose thoughts made our thoughts, and whose ways made our ways — the men who first dared to look on nature with the clear eyes of the mind... The veil of thaumaturgy which shrouded the Orient, while not removed, was rent in twain, and for the first time in history, man had a clear vision of the world about him — *had gazed on Nature's naked loveliness* (ADONAI) — unabashed and unaffrighted by the supernatural powers about him. Not that the Greek got rid of his gods — far from it! but he made them so like himself, and lived on terms of such familiarity with them that they inspired no terror. »

The author traces medicine through successive stages — a primitive stage in which it emerges as an empirical art from magic and religion, a stage in which the natural character of disease, as something explorable as cause and effect, is recognized, a stage in which anatomical structure and physiological function were established, a stage in which species of disease were determined clinically and anatomically, a stage in which the aetiology of disease was successfully investigated, and, finally, a stage in which we turn our real knowledge — the knowledge of causes — to account in sanitation. Throughout this evolution three principles in the development of scientific truth are noted — that truth grows gradually from a tiny germ (not spontaneously generated nor advancing *per saltum*), that truth in any one department of science is dependent for growth on the general state of knowledge, and that scientific truth alone, of all the mental treasures of the race, commands universal acquiescence.

The editors of this splendid volume and the Yale University Press deserve the gratitude of a wide range of readers. To many it will seem, even more than Sir WILLIAM OSLER's other posthumous work, *ultima manus magistri*.

WALTER LIBBY.

Ernst Schwalbe. — *Vorlesungen über Geschichte der Medizin*. Dritte, umgearbeitete Auflage, x+181 p, Jena, GUSTAV FISCHER, 1920.

The number of books dealing with the history of medicine which have appeared recently is astounding and in great contrast with the relative scarcity of books dealing with the history of many other sciences. Consider for example the following books, all of which except the first are fairly recent : PAGEL and SUDHOFF, Berlin 1915 (*Isis*, IV, 203); HERMANN VIERORDT, Tübingen 1916 (*Isis* III, 365); PREISLER, Copenhagen 1920 (*Isis*, IV, 109); FRANZ HÜBOTTER, Berlin 1920 (*Isis*, IV, 369); MEYER STEINEG und SUDHOFF, Jena 1921 (*Isis*, IV, 368); F. H. GARRISON, Philadelphia 1921 (*Isis*, IV, 554); Sir WILLIAM OSLER, New Haven 1921, (*Isis* IV, 556). It is remarkable also that all of these books, except two, are German.

Dr. E. SCHWALBE is professor of general pathology and pathological anatomy in Rostock. His book is very different from the others, the aim of it being philosophical or propædæutic rather than historical. It is obviously the outgrowth of lectures given to medical students and the emphasis is laid on the evolution of medical theories. Biography is reduced to a minimum. The professor's main purpose has been to explain to his students how the ideas which now dominate medical thought and practice have slowly been developed. There are only nine lectures, of which the first deals with generalities (the aim

of studies on the history of medicine; its relations to other developments); the 2nd with the general concept of disease, primitive and Hippocratic medicine; the 3rd with the period extending from HIPPOCRATES to GALEN; the 4th with late ancient and mediæval medicine; the 5th with the Renaissance (from VESALIUS to HARVEY); the 6th with HARVEY to HALLER; the three last with modern conditions.

This short outline makes an excellent introduction, which would be largely sufficient for the majority of physicians or laymen. Would that every physician had read this book or another equivalent to it! —This is the 3rd edition; the 1st appeared in 1905; the 2nd in 1909. The tables compiled by ASCHOFF which were appended to the previous edition have not been republished. Otherwise there is no essential difference between the three editions, except that the author has taken pains to remove all foreign words from the last. Considering the conditions obtaining in Germany today, this nationalistic move is excusable.

GEORGE SARTON.

Karl Sudhoff. — *Skizzen*, small octavo, 319 p. and Register, portrait. Leipzig, F. C.W. VOGEL, 1921.

In this unusually attractive volume we have Prof. SUDHOFF in the double rôle of medical historian and GÖTTE-forscher. Of his twenty eight papers dealing with medical history, we may say that they constitute in effect a retrospective review of some part of the author's major labors during the past twenty two years. Here, in scarce the space that would suffice for « Contes rapides », SUDHOFF's program, methods and results stand fairly revealed — if not to outsiders and arrivists, at least to his spiritual heirs, to whom the book is dedicated. Rapid in execution, intimate in spirit, adroitly proportioned, the varying components of the volume fall finally into an uncanny and uncalculated symmetry and unity. By some heavenly alchemy he mixes such immiscible elements as « Medicine in the Stone Age » and « HOHENHEIMS literary remains ».

He subtly manages to associate, arrange and harmonize, until what was discreet, becomes confluent, so to speak, like the patterns in a Japanese priest robe. Each tract is a strong persuasive to the intensive study of the past, for the liberation and enrichment of the mind that comes from such study methodically pursued; each tract is an eloquent invocation to search our racial memory — especially when we are confronted by novelty. For it is grievous mischief to science that everything that proclaims itself new is taken at its own valuation. Here History lays a finger upon us pausefully and bids caution.

« Die Geschichte einer Wissenschaft ist die Wissenschaft selber ». This pronouncement by GOETHE forms the key-note of the volume. After dealing with methodology of history, the work of medical history in relation to its kinds of matter, Prof. SUDHOFF has a very notable chapter on « periodization » and another on « medical archaeology » in which the brush-work is broad and the results seizing. His answer to the question « What is the history of medicine? » firmly engages the reader's interest. His account of the more important « schools of medicine », which is a reprinting of his article in SARASON'S *Jahreskurse für ärztliche Fortbildung* Sept. 1918, is perhaps the most illuminating sketch in the book. All are too brief — an epic sweep, a Dantesque compression, characterize them all, as the reader will soon become aware. *Medicine and Art* and *Painting and the History of Medicine* we could wish extended tenfold. Less than three pages are allotted to HERMANN BAAS and less than seven to JOHANNES MÜLLER — but we cannot quarrel with the author for are we not warned by the title that this is a sheaf of sketches?

Great satisfaction will it be to the GOETHE-kenner to find in this volume that the final fifth portion is wholly devoted to his man of men. All pass the Gods of Weimar, but few salute them with the same familiar salutation that SUDHOFF gives them. A profound GOETHE scholar and GOETHE-forscher in his youth, our author pays his « occasional » respects to the memory of that great name, with a high charm and distinction that reveal his own worth, his own ideal of a unified life.

We draw increase of pleasure from these pages at the thought of the refreshment they will afford some of our friends; SPECK in his laden treasure-room of GOETHE-items in New Haven, MACKALL in Savannah, and countless others of the Cult. SUDHOFF's loyal return to GOETHE, like his continuing loyalty to HOHENHEIM, attests a constancy unshakable. Henceforth his name in science is indissolubly bound up with the names of THEOPHRASTUS VON HOHENHEIM and of GOETHE. How various influences flowing from these two master-minds have worked together to give such a distinctive and definitive direction to SUDHOFF's career, would prove no tax upon an E minus intelligence to demonstrate, to a certainty.

This work of his, on the whole, presents a solvent to many of those difficulties imminent in teaching and research in medical history. It presents a proper procedure and criteria. It presents a venturesome edge of argument here and there yet carries no controversial matter, no latinity, no esoteric apparatus of scholarship to dismay the uninitiated. In short it should appeal, through its largeness of sympathy,

variety and brisk vigor of execution, to a very wide circle of readers outside of the medical profession.

(Boston.)

EDWARD C. STREETER.

Mach, Ernst. — *Die Prinzipien der physikalischen Optik, historisch und erkenntnispsychologisch entwickelt*, x+444 S., in-8°, 279 Fig. und 10 Bildnisse. Leipzig, J. A. BARTH, 1921.

[Geheftet 48 M., geb. 60 M.]

Die Kunde von ERNST MACHS Tode (19. Februar 1916) haben seine Freunde und alle Kenner seiner Lebensarbeit sicherlich mit grosser Bewegung aufgenommen. Aus den Nachrufen ging hervor, dass Gelehrte der verschiedensten wissenschaftlichen Richtungen sich durch ihn bereichert und eigenartig angeregt fühlten. Er vermochte im Zeitalter der aufblühenden Entwicklungslehre und der ersten grossen Triumphe der Molekulartheorie leitende Ideen des nächsten Zeitalters — desjenigen der Anwendungen der Entwicklungslehre und der Kritik der molekularen Vorstellungen — vorweg zu nehmen und durch seine stille, doch fortschreitend mehr anerkannte wissenschaftliche Arbeit dem gegenwärtigen Positivismus in Deutschland ein gut Teil seines besonderen Gepräges zu verleihen. Als Physiker zeichnete er sich in akustischen und optischen Untersuchungen durch besondere Feinheit der experimentellen Methoden aus; seine zahlreichen experimentell-psychologischen Arbeiten ragen durch die durchdringende Methode seines Denkens hervor. Von Bedeutung sind hier die Arbeiten über die Ton, Raum- und Zeitempfindungen und besonders jene über Bewegungsempfindungen geworden. Seine wissenschaftsgeschichtlichen Arbeiten brachten die neue Methode, die Entstehung und den Werdegang der wissenschaftlichen Ideen kritisch zu durchforschen, um aus den Begriffen und Theorien den Tatsachenkern zu schälen und sie alles metaphysischen und hypothetischen Beiwerks zu entkleiden. Von dieser Art waren: *Die Mechanik in ihrer Entwicklung, historischkritisch dargestellt* (1883), und *Die Prinzipien der Wärmelehre, historisch-kritisch entwickelt* (1896). Aber auch sein berühmtes psychologisches Werk *Die Analyse der Empfindungen* (1885) hat auf die historisch interessierten Naturforscher allmählich grossen Einfluss gewonnen, desgleichen einige seiner *Populär-wissenschaftlichen Vorlesungen* (1896) und schliesslich sein zweites erkenntniskritisches Hauptwerk *Erkenntnis und Irrtum* (1905). Die Wissenschaft ist für MACH Ergebnis der *Anpassung der Gedanken an die Tatsachen und aneinander*; sie ist als ein organisches Gebilde aus dem Daseinskampf hervorgegangen und von der Denkweise des

primitiven Menschen nur dem Grade nach verschieden. Ihre Begriffe, Systeme, Theorien und Gesetze sind Zusammenfassungen der Tatsachen im ökonomischen Interesse und nachökonomischer Methode; sie folgen den — sinngemäss angewendeten — darwinistischen Grundsätzen der Vererbung und Anpassung. Die Atome und Moleküle, von den Zeitgenossen als die letzten Realitäten angesehen, waren schon für den jungen MACH nur « Gedankensymbole », dienlich oder nach Umständen auch hinderlich bei der ökonomischen Beschreibung der physikalischen und chemischen Erscheinungen. Dem Bedürfnisse folgend, eine gemeinsame theoretische Grundlage für die physikalische, die physiologische und die psychologische Forschung zu finden, war er schon früh zu ganz anderen *Bausteinen der Welt* gelangt: die einfachsten *Empfindungen* bezeichnete er, um jeder philosophischen Deutung auszuweichen, als « Elemente » und zeigte, wie auch Mathematik und Physik nicht minder als die Psychologie in letzter Linie auf sie, die *vorläufig* unzerlegbaren, zurückzuführen sind. Diese Gedanken-gänge erfuhren zunächst in der deutschen Wissenschaft unterschiedene Ablehnung, brachen sich aber noch zu MACHS Lebzeiten Bahn und wirkten bei der Konzeption von OSTWALDS energetischer Naturphilosophie und bei der Weiterentwicklung des Positivismus in Deutschland entscheidend mit. So konnte der Gelehrte, seit 1898 durch die Folgen eines Schlaganfalles seiner Lehrtätigkeit entzogen, von seinem Wohnsitze in Wien aus, den er später mit einem kleinen Orte bei München vertauschte, die Früchte seiner Arbeit reifen sehen. Seine Gedankengänge waren mit jenen verwandter Denker, die jedoch von anderen Gesichtspunkten ausgegangen waren, zusammengetroffen, insbesondere mit jenen des Züricher Philosophen RICHARD AVENARIUS (1843-1896). Die Synthese beider wollen die Vertreter des gegenwärtigen « relativistischen Positivismus » vollführen.

MACHS persönliche Freunde rühmen seine lautere Bescheidenheit und die ausserordentliche Abgeklärtheit seines Wesens, die man nur als *Welsheit* bezeichnen kann. Sein Tod wurde seinem Wunsche gemäss erst nach der erfolgten Einäscherung bekanntgegeben.

Als bald wurde auch bekannt, dass von ihm noch ein nachgelassenes Werk über die Geschichte der Optik erscheinen solle. Das vorliegende Buch ist der erste Band des Werkes. Im Vorworte sagt der Verfasser, das Buch sei aus Vorlesungen an der Prager Universität entstanden. « Ich hoffe nicht ohne Erfolg das Entstehen der Begriffe der Optik und den historischen Faden ihrer Entwicklung, befreit von metaphysischem Ballast, blossgelegt zu haben. Ergebnisse historischer Forschung sind hier aber nicht zusammengetragen, und einzelne von anderer Seite erschöpfend behandelte Kapitel nur gestreift ».

Im dem (1913 geschriebenen) Vorwort nimmt MACH ferner Stellung

zur Relativitätstheorie und seine Äusserung wird nicht verfehlen, in der wissenschaftlichen Welt Aufsehen zu erregen. Er nehme wahr, dass man ihm die Rolle eines Wegbereiters jener Lehre zudenken wolle. Doch lehne er persönlich die Relativitätstheorie ab und werde seine Gründe dafür im zweiten Bande darlegen. Die Theorie werde gewiss bleibende Werte schaffen, werde sie sich aber lange behaupten können und in der Geschichte der Wissenschaft mehr als ein geistreiches *Aperçu* bedeuten? Dem ist gegenüberzustellen, dass EINSTEIN in seinem Nachrufe für MACH diesen als Vorläufer der Relativitätslehre behandelt und es als nicht unwahrscheinlich erklärt hat, dass MACH zu dieser Lehre gekommen wäre, wenn in der Zeit, als er jugendfrischen Geistes war, die Frage nach der Bedeutung der Konstanz der Lichtgeschwindigkeit schon die Physiker bewegt hätte (*Physikalische Zeitschrift*, 1916). Ist demnach MACH, als die jüngere Generation zur Relativitätslehre kam, bei älteren Anschauungen stehen geblieben, oder hat er weiter geblickt als jene? Man darf dem zweiten Bande des Werkes nun mit um so grösserer Spannung entgegensetzen.

Nach einer Einleitung, in welcher er die allgemeinen Gesichtspunkte seiner Wissenschaftstheorie auf die Lehre vom Lichte anwendet, geht MACH zu folgenden Gegenständen über: Geradlinige Ausbreitung, Reflexion und Brechung des Lichtes; Farbenlehre; Periodizität und Interferenz, Polarisation, Beugung. In 14 Kapiteln wird die Entwicklung dieser wissenschaftlichen Begriffe einzeln verfolgt. Der Verfasser schildert zum Teil eingehend die ersten Beobachtungen, analysiert die gezogenen Folgerungen, teils durch eigene Anwendungen; er geht, soweit es in exakter Weise möglich ist, auf die Motive der Forscher ein, berücksichtigt den mehrfach störenden oder verzögernden Einfluss ihrer hypothetischen Anschauungen über die Natur des Lichtes und fasst die von ihnen gewonnenen Einsichten wiederholt zu hypotesenfrei formulierten Grundsätzen zusammen. An mehreren Stellen demonstriert er diese durch sinnreich erdachte, einfache Versuche. Anschaulich tritt die Arbeitsweise eines GRIMALDI, HUYGENS, NEWTON, FRESNEL, zutage; bei HUYGENS tritt die « Anpassung der Gedanken aneinander » sogar dort in deutliche Erscheinung, wo die Wellenlehre durch die Beobachtungen, die sich dem « Sohne eines seefahrenden Volkes und dem Bewohner einer von Kanälen durchzogenen Stadt alltäglich darbieten mussten », angeregt werden konnte, und der Historiker zeigt solche mögliche Zusammenhänge im einzelnen auf.

Die behandelten Kapitel greifen nicht so tief in naturphilosophische Fragen ein wie viele in der Mechanik oder Wärmelehre besprochenen. Trotzdem wird auch der philosophisch gerichtete Leser reiche Anregung in dem Buche finden; für den Fachmann bildet es eine Fundgrube interessanter Gesichtspunkte.

[Brünn (Mähren).]

ERNST BLOCH.

Friedrich Dannemann. — *Die Naturwissenschaften in ihrer Entwicklung und in ihrem Zusammenhange*, 2te Auflage, II. Band. Von GALILEI bis zur Mitte des XVIII. Jahrhunderts. Mit 133 Abb., x + 508 S. Leipzig, ENGELMANN, 1921.

The first edition of this volume appeared in 1911 (1). It is clear that the author has taken pains to enlarge and improve both the text and the illustrations of his work. Two new chapters have been added, namely those bearing the nos. 7 and 21 in the list below. It is interesting indeed to reproduce briefly Dr. DANNEMANN's plan. After quoting the title of each chapter, I have added a few words between brackets to show more precisely what it contains.

1. Antiquity and modern times (contrast between ancient and modern thought, historical background); 2. New instruments for research (microscope; telescope); 3. GALILEO (not less than 61 p. are devoted to him, but that does not seem too much; the author has accepted too readily WOHLWILL's conclusions); 4. Extension of inductive research (Accademia del Cimento, BORELLI, thermoscope, RICCIOLI, GRIMALDI, GILBERT and GUERICKE, BACON); 5. TYCHO and KEPLER (JOHANN HEVEL); 6. Influence of mathematics upon the progress of natural sciences (STEVIN, VIETA, GIRARD, CARDANO — DESCARTES, FERMAT — NEWTON, LEIBNIZ); 7. Relations between science and the new philosophy (DESCARTES, GASSENDI, HUYGENS, NEWTON, LEIBNIZ); 8. Elaboration of the physics of fluids (STEVIN, TORRICELLI, PASCAL, GUERICKE, BOYLE, MARIOTTE); 9. Further development of iatrochemistry and foundation of scientific chemistry by BOYLE (HELMONT, LIBAVIUS, GLAUBER, BOYLE, JOHN MAYOW); 10. Development of botany and zoology (CLUSIUS, LOBELIUS, MATTIOLI, K. BAUHIN — CAESALPINO — JOACHIM JUNGIUS, TOURNEFORT — JOHN RAY); 11. Foundation of scientific academies; 12. NEWTON; 13. HUYGENS and other contemporaries of NEWTON (the BERNOULLIS, MARIOTTE, HALLEY, CASSINI, TSCHIRNHAUSEN, LEIBNIZ; this chapter is very long; it would have been advisable to cut it in two); 14. Foundation of modern mineralogy and geology (STENO, KIRCHER, BARTHOLIN, KUNKEL, BECHER, MARGGRAF); 15. Anatomy and physiology (HARVEY, HOOKE, BORELLI, MALPIGHI); 16. First results of the microscopical study of lower animals (SWAMMERDAM, REDI, MALPIGHI, LEEUWENHOEK); 17. Foundation of the anatomy of plants, discovery of their sexuality (HOOKE, GREW, MALPIGHI, CAMERARIUS); 18. Further development of mechanics, optics and acoustics (the BERNOULLIS, EULER, JOHN HARRISON, SAUVEUR, D'ALEMBERT, LAGRANGE, LAMBERT, CHLADNI); 19. Pro-

(1) I reviewed it in the *Revue générale des sciences*, t. 23, p. 202, 1912. — See also *Isis*, II, 218; IV, 110.

gress of astronomy and celestial mechanics (MAUPERTUIS, CLAIRAUT, HALLEY, MASKELYNE, BRADLEY, LAMBERT, EULER); 20. Mineralogy and geology in XVIIIth cent. LINNÉ, CRONSTEDT, BERGMANN, ROMÉ DE L'ISLE, LEHMANN, FÜCHSEL, GUETTARD, BUFFON, PALLAS, SAUSSURE, WERNER, HUTTON, KNORR); 21. Natural science and the period of enlightenment (only a few pages).

This outline shows that Dr. DANNEMANN's work is very comprehensive. In that respect it is far more satisfactory than the first volume, which was altogether too sketchy. The explanations are clear and simple. Corrections have been made in the text by Ed. O. VON LIPPMANN, and a few additional notes contributed by E. WIEDEMANN and J. WÜRSCHMIDT are printed at the end. The bibliographic notes refer chiefly to OSTWALD's *Klassiker* and to other German publications, but the author of a semi-popular book is justified in doing so. In the absence of any other work comparable to it, Dr DANNEMANN's history deserves to be translated into English.

GEORGE SARTON.

Br. Petronievics. — *L'Évolution universelle. Exposé des preuves et des lois de l'évolution mondiale et des évolutions particulières (inorganique, intellectuelle et sociale)* I. *L'Évolution mondiale, inorganique et organique*, 214 p. (200 × 125), 3 fig. et 1 tableau dans le texte. Paris, FÉLIX ALCAN, 1921. [fr. 7.50]

Très étendue par son programme, quoique petite dans ses dimensions, est la première partie du nouvel ouvrage de BR. PETRONIEVICS, professeur à l'université de Belgrade, dès longtemps adonné à la métaphysique, et auteur de *Principes de la théorie de la connaissance*, de *Principes de métaphysique* (deux vol. parus), et d'un travail sur *Les géométries typiques et l'Infini*, tous publiés en langue allemande de 1900 à 1912.

L'auteur ne se propose en effet rien moins que de traiter le problème de l'évolution considérée dans toute son étendue, laissant cependant de côté la question des *causes* du problème évolutif, pour laquelle bien des solutions ont été proposées, sans qu'il soit possible de tenir aucune d'entre elles pour définitive. Il se borne donc à exposer les preuves de l'évolution, à en discuter la valeur objective, à en déterminer le degré de certitude, et à énoncer ses lois principales, dans la mesure où on les connaît.

Qui dit évolution universelle dit à la fois évolution de l'univers considéré dans la totalité des choses existantes (le problème est ici d'ordre métaphysique), et évolution dans les domaines particuliers de la réalité, fait d'ordre scientifique. BR. PETRONIEVICS aborde donc ces

deux ordres de questions, mais réserve cependant pour un second volume l'évolution intellectuelle et sociale, et la loi générale de l'évolution.

L'ouvrage débute par un court exposé historique du développement de l'idée d'évolution, de THALÈS à BERGSON, puis vient une bonne définition du concept d'évolution, considérée comme « le devenir d'une chose par degrés successifs de changements », cette définition impliquant à la fois changements, devenir, et degrés, sans rien préjuger sur la direction suivant laquelle se font ces changements.

Les chapitres suivants sont consacrés au problème de l'évolution totale de l'univers (considérée par l'auteur comme hypothétique), de l'évolution inorganique et de l'évolution organique, le tout exposé avec beaucoup de clarté, avec une méthode rigoureuse. Malheureusement, PETRONIEVICS a laissé passer ici des erreurs qui, quoique ne diminuant pas l'exactitude des lois énoncées, jettent un trouble sur la légitimité des conclusions qui viendront couronner son édifice. Il considère, par exemple, l'existence de l'éther comme établie expérimentalement; il croit que la principale source qu'on puisse imaginer pour l'énergie solaire, c'est la contraction, le travail mécanique produit par la gravitation se transformant en chaleur; les nébuleuses sont pour lui des masses gazeuses froides, etc.

Mais il y a plus : ce travail dans lequel se trouvent groupées, critiquées avec beaucoup de soins judicieux, les lois si nombreuses qu'on a cru pouvoir énoncer relativement à l'évolution du monde organique, est rendu de lecture très pénible par le nombre de fautes d'impression, d'erreurs typographiques, d'incorrections de langue qu'on y a laissé passer. Il mérite infiniment mieux que la présentation qui nous en est donnée; et il faut souhaiter que lors de la parution de la seconde partie, celle dont nous venons de nous occuper soit rééditée avec plus de soin, avec un souci plus grand de déférence pour le lecteur; à cette occasion, l'auteur pourrait aussi, puisque l'œuvre s'adresse surtout à des lecteurs de langue française, donner dans ses notes bibliographiques, les indications des traductions françaises des ouvrages auxquels il se réfère — ils sont presque tous traduits — et non pas seulement celles des mémoires originaux.

L. GUINET.

Edmond Goblot. — *Le système des sciences.* (Le vrai, l'intelligible, le réel, 259 p. (190 x 120); Paris, ARMAND COLIN, 1922. [7 fr.]

Ce livre, dans lequel GOBLOT nous donne quelques résultats de ses recherches sur la science et la philosophie, a pour origine une série de conférences faites en 1921 à l'Université de Barcelone. On retrouve naturellement au cours de cette revue du système de la science dans

laquelle l'auteur cherche, non pas des ressemblances et des différences qualitatives, mais des rapports de dépendance et de subordination, bon nombre des idées déjà exposées dans l'*Essai sur la Classification des Sciences* (1898), et dans le *Traité de logique* (V. *Isis*, III, 306-307).

L'idée centrale est la suivante : la science part de l'expérience, c'est-à-dire « du réel, et tend à l'intelligible. Plus elle est élaborée, plus elle est loin de la réalité. Mais nous disons qu'elle est vraie quand elle sert utilement et sans mécomptes notre commerce avec la réalité » (p. 88).

Les notions fondamentales qui sont à la base des grandes familles de science sont des notions empiriques : quantité pure en arithmétique et en algèbre, espace (la seule chose qui soit directement mesurable) en géométrie, espace et temps en mécanique, matière en physique, espèces de matière en chimie, etc., fonctions de *convenance complexe* (adaptées) constituant des processus complets de *finalité*, c'est-à-dire ayant un terme initial, des termes moyens et un terme final, pour les sciences biologiques, la psychologie et les sciences morales.

Mais si partout l'esprit part de l'expérience, nulle part il ne s'en contente ; de même que l'évolution de la physique, par exemple, va vers la mécanique rationnelle, de même toutes les sciences, d'abord empiriques, tendent à devenir rationnelles. Et la métaphysique elle-même, qui se prétend science abstraite, comporte une part d'empirisme, puisqu'elle ne peut atteindre le réel sans faire appel à l'expérience, celle-ci pouvant seule nous apprendre que quelque chose est. « Il n'y a donc pas de philosophie en dehors de la science ».

L. GUINET.

Holländer, Eugen. — *Wunder, Wundergeburt und Wundergestalt in Einblattdrucken des fünfzehnten bis achtzehnten Jahrhunderts.* Kulturhistorische Studie, xvi+373 p., 202 illustr, Stuttgart, ENKE 1921.

Dr. HOLLÄNDER's studies on the relations of art and medicine are well known (1). The collection of prints dating from the xvth to the xviii century, which he is now offering us is not simply of medical interest, it will be of great value to the historian of thought, chiefly the historian of mass psychology and superstition, to the psychologist and the philosopher. It is a collection of monstrosities, most of them human. The uneducated people have always been intensely interested in monsters, chiefly in those of their own race. This curiosity is closely akin to the love of the marvellous, of the abnormal, whichever it be, and, although it is not necessarily morbid, it is dangerously

(1) See *Isis*, IV, 370.

similar to various unhealthy superstitions, such as those connected with devilry, sorcery and black magic. That such curiosity is still flourishing is sufficiently proved by the fact that no circus would be deemed complete without its miserable retinue of human monsters: giants, dwarfs, misformed men, bearded women and the like. There are still enough people in the most civilized nations to admire the vulgar patterns of a tattooed body or to pay tribute to the fat woman.

To give an idea of the variety of Dr. HOLLÄNDER's teratological gallery, the best that I can do is to enumerate a few of the subjects. Monstrous babies (double ones; others partly or irregularly developed). Monstrous animals. Armless men. Giants. Dwarfs. Hairy men, bearded women. Centenarians. Horned men. Acardiaci. This first section dealing with anatomical monstrosities contains about 5 incunabula and 21 xvth cent. prints. The following sections will be of greater interest to the student of human folly, for they deal with the love of wonders. Dr. HOLLÄNDER shows us curious prints illustrating witchcraft; fantastic animals; transformation of men into animals (prints dated 1673 and 1701); marvellous peculiarities of plants and animals; extraordinary fasting or eating; bloodsweating; stigmatisation; women bringing forth animals; miracles connected with hosts; marvellous eggs; one-legged men; headless men; men with tails... In the final sections the author examines the attitude of the Church with regard to monstrosities, their reaction upon fashion and politics and the theories imagined to explain them (ARISTOTLE; KONRAD VON MEGENBERG; fears or dreams of the mother during pregnancy, etc.).

An abundant commentary is added to the illustrations and an introduction explains the attitude of antiquity with regard to monsters (hermaphrodites for ex.). The author has also provided a short bibliography but no index. The prints are very well reproduced, — in fact it seems to me, too well. For the luxury of this melancholy book is rather painful, especially in a time of scarcity. It must be admitted, moreover, that the greatest number of these drawings are ugly and unpleasant, and their lack of artistic value is hardly compensated by their scientific interest. Yet this inquiry had to be made, and Dr. HOLLÄNDER was unusually well prepared to make it well.

GEORGE SARTON

Edward Lawrence. — *Spiritualism among civilised and savage races.*

A study in anthropology, xiii+112 p., 6 illustr. London, BLACK, 1921.

The burden of this little book is « that no difference exists between the savage's idea of a spirit world and that entertained by modern

spiritualists. In both cases spirit-land is not far away, as the Christian conceives Heaven and Hell to be, but nearby, in, and surrounding, the present material world. And in that land of ghosts everything goes on just as it does in the world of flesh ». To accomplish his purpose, the author has given us a clear summary of spiritualistic beliefs, on the one hand among European and other civilized races, on the other among barbaric and savage races. He has performed a very useful task in denouncing the crude and disgraceful superstitions too often associated with spiritualism. He is essentially right when he claims that « spiritualism is nothing but the fag-end of an old superstition — a superstition which obsesses the mind of barbaric man, because he does not possess the necessary knowledge which explains natural phenomena, a knowledge which only modern science is in a position to furnish ». Yet his case would have been much stronger if he had been careful to state that some of the purer ideas underlying the spiritualistic belief are not necessarily wrong. Science can not yet tell us anything about the human soul; but it does not follow that positive knowledge of facts concerning souls, ghosts and spirits is necessarily unobtainable. The true scientific attitude is one of doubt and reverence. It is pretty certain, however, that if we are to know anything about psychic phenomena it will not be by the grotesque means used by uncritical people sitting in the dark around a tipping table that we will discover it, but by the rigorous application of the best scientific methods. It is also a pity that LAWRENCE should have spoiled his otherwise excellent argument by phrases which smack more of controversy than of dispassionate criticism. For example, after having spoken of the performance of a South American medicineman, he concludes by remarking that the wizard « medium-like, demanded payment ». Now, mediums, like priests, must live; if some of them show a rapacious disposition, it does not follow that their « religion » is false. Such remarks are irrelevant. I wish that a new edition may soon give the author an opportunity to revise his book from that point of view. As far as he denounces superstition and unreason I am entirely in sympathy with him.

GEORGE SARTON.

William Radcliffe (Sometime of Balliol College, Oxford). — *Fishing from the earliest times*, xvii+478 p., illustrated, New York, DUTTON, 1921. [10 dollars.]

This is an encyclopaedia of fishing from the earliest times down to about the Vth century, but the author's irrepressible discursiveness causes him to speak not simply of fishing and fish but of many other

things and to forget as well his chronological limit. The historian of zoology will find in it a great deal of fish-lore which RADCLIFFE has patiently « fished » in the literature of all nations and all times. Of course to the scholar this discursiveness is nothing less than unpleasant and the author's efforts to be witty in and out of season become quickly irritating. It seems a pity that such a good classical scholar has not derived more discretion from his old acquaintance with Greek culture. The *μηδὲν ἄγαν* has apparently made but little impression upon him! We must be grateful to him, however, for the pains he has taken; we will forget his preciosity and his discursiveness for the sake of his « serendipity » and remember that this book of his is the first complete account of fishing in ancient times.

After an introduction in which pre-historic conditions are briefly dealt with, the author treats successively Greek and Roman fishing (235 p.), Egyptian fishing (45 p.), Assyrian fishing (45 p.), Jewish fishing (49 p.) and finally Chinese fishing (20 p.). According to the author (whose theory is but one among others), prehistoric fishing developed in the following order: fishing with the hand; with the hunting spear; with a line of some sort; with a net. By the way, it is a remarkable fact — well emphasized by RADCLIFFE — that the line of both the ancients and the moderns down till the xviiith century was a tight, as opposed to a running line. For his account of Egyptian methods, he has made good use of ORIC BATES' monograph, 1917 (1). The earliest representation of angling is an Egyptian painting of Beni Hasan dating from c. 2000 B. C.; the next one is a Theban painting of c. 1400 B. C.: in both cases a rod is used. Now it is extremely curious that the ancient Babylonians and Hebrews despite their long connection with Egypt, never employed the rod! This fact should be compared with the many cases reported by FLINDERS PETRIE (2) with reference to Egyptian tools and weapons and be a new warning to historians who underestimate nearly always the inherent originality of peoples. The earliest recorded contract of fishing occurs in the second year of Darius II, 422 B. C.; it deals with netting in Babylonian waters; RADCLIFFE gives its full text, as also of a similar document dated 419 B. C. (3). His book brings us a new tribute to ARISTOTLE'S wisdom, for (as THOMAS E. LONES had pointed out before, in 1912) ARISTOTLE was the first to note that the scales of a fish make possible

(1) See *Isis* IV, 426

(2) See *Isis*, III, 314.

(3) See *Isis*, III, 317.

a shrewd, in the case of *murex* an exact, computation of its age (1). RADCLIFFE argues that the following lines of MARTIAL (Ep., V, 18, 7):

Namque quis nescit
Avidum vorata decipi scarum musca?

are the first mention of fishing with a fly, and furthermore that the allusion refers to an *artificial* fly. That is hypothetical, however, and the more so that some critics prefer the reading *vorato... musco*. At any rate, AELIAN (beg. of IIIrd cent.) explains the « Macedonian invention », that is, the use of an artificial fly, in his Natural History (XV, 1). No other mention of it is known down to Dame JULIANA's Book (c. 1500). If MARTIAL must be denied the honor of this priority, he may at least be acclaimed as being the author of the first notice « fishing strictly prohibited » (IV, 30):

Baiano procul a lacu recede
Piscator: fuge, ne nocens recedas.

As an instance of RADCLIFFE's discursiveness, let me say that apropos of various superstitions connected with fishing, he speaks of the fanciful ideas entertained for some two thousand years on the propagation of Eels, ending with a clear summary of the true explanation discovered in 1904 by JOHANN SCHMIDT of Copenhagen. SCHMIDT found in September 1920 that the spawning place of European fresh water Eels is not far S. of Bermuda (ab. 27° N., 60° W.), much farther W. than he anticipated. This is rather a welcome digression; they are not all equally happy.

The most interesting part of the book to me is the very brief account of the history of pisciculture, which will be found in two places (p. 289-293; 461-464). The Chinese developed this art at an early date. The first pisciculturist, as also the earliest writer on the subject, was T'ao CHU KUNG (= FAN LI) who lived in the VIIth century B. C. It must be admitted, however, that his « Treatise on Fishbreeding » (*Yang Yü Ching*) is a strange production. A Board of Fisheries had been established in China many centuries before Christ, and the *Chou Li* already alludes to an organization of that sort. The earliest Western writer was the Roman VARRO (first cent. B. C.). But it should be noted that the method of both the Chinese and the Romans was to gather eggs

(1) cfr. *Natural History*, VIII, 30: « the old fish are distinguishable by the size and the hardness of their scales »; *Ibidem*, V, 15: « the *murex* lives for about six years and the yearly increase is indicated by a distinct interval in the spiral convolution of the shell ».

already naturally fertilized. Dom PICHON (1), a monk of the abbey of Réome, who wrote about 1420, seems the first to have conceived the idea of artificially fecundating the eggs of fish (trout), (p. 291, « he pressed out in turn the milt of a male and the eggs of a female into water, which he then agitated with his finger... »). LEONARD MASCALL gave recipes for preserving spawn in his *Booke of Fishing*, 1590. But we have to wait until the middle of the xviiith century to obtain practical results, the first of which were obtained by the Swede LUND. The first to achieve considerable success (at about the same time) was JACOBI of Westphalia, who for his services was granted by England a pension for life. In 1845 two fishermen of La Bresse, RÉMY and GÉHIN, were given a prize by the Society of the Vosges for a similar achievement: on investigation by the Academy of Sciences in 1849, it was found that they had been led from conclusions based entirely on their own observations, for they were quite unlettered and ignorant! How is it then that a discovery of such vital importance was not made before? I wish I knew more about these great benefactors of mankind (2).

G. SARTON.

(1) Who was this Pichon or Pinchon? The author uses both spellings and gives no reference! And where is the Abbey of Réome? Should it not be La Réole, near Bordeaux? RADCLIFFE says that the elusive MS. of Dom PICHON was written about 1420 but only rediscovered about 1850. Where and by whom?

(2) RÉMY and GÉHIN were two fishermen. I have not been able to find any other information on the latter, but a few lines are devoted to JOSEPH RÉMY (b. in La Bresse, Vosges, 1804-d. 1855) in the *Grande Encyclopédie*. I wish one of the French correspondents of *Isis* could be persuaded to tell us the lives of these two great men.

Twelfth Critical Bibliography

of the

History and Philosophy of Science and of the History of Civilization

(to March 1922).

This Twelfth Bibliography contains 538 notes, of which a few have been contributed by A.-K. COOMARASWAMY (Boston), L. GUINET (Brussels), P. MASSON-OURSSEL (Paris) and C. SCHOY (Essen). The arrangement and leading principles of this bibliography have been fully explained in vol. III, 159-170; a complete plan of classification will be found also in the present volume, p. 124-125. The reader will keep in mind that Part I is the fundamental classification (centurial) and that Parts II and III contain only such items which could not be included in Part I.

I may add that I am preparing an « Introduction to the History and Philosophy of Science », which will contain a critical and synthetic bibliography of the whole field (see *Isis*, IV, 23-31). When the Introduction is published (in 1924?) the Critical Bibliographies appearing in *Isis* will be, so to say, periodical supplements to it. It is hoped that the scholars who do not yet see the value of our classification will understand it better when this Introduction has enabled them to survey with comparative ease the whole field of scientific endeavor throughout the ages.

I am anxious to obtain the assistance of more collaborators in order that this bibliography be as good as possible. I would be especially grateful to scholars who would undertake to sub-edit one of the chapters, *e. g.* Greece, or Middle Ages, or astronomy, or botany. The best result would be obtained if every special chapter were edited by a specialist. But that would require teamwork of the first class, and the more so in that Parts II and III should remain subordinate to Part I. There are still other ways to collaborate to this bibliography: one may undertake to analyze a certain number of periodicals, or else send in separate notes at random.

As this bibliography appears only twice a year I beg the authors to take pains that books and papers on the history and philosophy of science and the history of civilization be sent to me as soon as

they are published. Even then almost a year may elapse before they are included.

The aim of this bibliography is to establish the History of Science as an independent discipline and to serve as a center of information and a rallying ground to the scholars engaged in these studies. I can not succeed entirely without their assistance, and they can help me in many ways. To serve them, as well as I can, is both my duty and my pleasure. Critical work must be approached in a spirit of service or left untouched.

Harvard Library 183,
Cambridge, Massachusetts.
Easter 1922.

GEORGE SARTON.

PART I.

Fundamental Classification (centurial).

S. VIII A. C.

Sidersky, D. L'inscription de Silohé. *Journal asiatique*, t. 11, p. 558-561, 1918. 1818

Cette inscription, éditée et traduite par SIDERSKY (la première édition en fut faite par CLERMONT-GANNEAU en 1888), relate le percement du canal de Silohé pour amener l'eau dans la Cité de DAVID, travail accompli sur l'ordre d'EZÉCHIAS, roi de Judée (VIII^e siècle av. J.-C.). G. S.

S. VI A. C.

Jayaswal, K. P. Another Śaishunaka statue. *Journ. Bihar and Orissa Research Society*, vol. V, p. 550-551, 1919. 1818

Refers to the Parkham image in the Mathurā museum, hitherto regarded as Mauryan. The inscription is read as referring to KUṆIKA AJATAŚATRU (d. 518 B. C.). See the same author's Statues of two Śaishunaka emperors, in the same volume. (S. V. A. C.) A. K. C.

Van Buren, Mrs. E. Douglas. Figurative terra-cotta revetments in Etruria and Latium in the vith and vth centuries B. C., 32 pl. London, MURRAY, 1921. 1818

S. V A. C.

Ehrenberg, Victor. Zu HERODOT. *Klio*, t. 16, p. 318-331. Leipzig, 1920. 1818

(1) Zu HERODOTS Angaben über die Gestalt Aegyptens (corrections to C. SOURDILLE. La durée et l'étendue du voyage d'HÉRODOTE en Égypte, Paris, 1910; which EHRENBURG considers to be the best book on the subject; (2) Die Quelle des skythischen Stammsage in IV, p. 8-10. G. S.

- Jayaswal, K. P.** Statues of two Śaśunaka emperors (483-409 B. C.). *Journ. Bihar and Orissa Research Society*, vol. V, p. 88-106, 1919. ISIS

This very important paper, read in conjunction with the articles by BANERJI, R.-D.; BHATTACARYA, B.-C.; SMITH, V.-A.; BARNETT, L.-D.; SEN, A.; HARAPRASĀD ŚĀSTRĪ; and Mr. JAYASWAL'S reply in the same volume, and the remarks by SMITH, V.-A., in *Journ. Roy. Asiatic Soc.*, London, 1920, p. 154-155 shows that certain splendid and massive sculptures in the round hitherto dated as Mauryan must be regarded as statues of pre-Mauryan kings. The sculptures referred to include particularly the two figures from Patna now in the Calcutta Museum, and some others. The paper by HARAPRASĀD ŚĀSTRĪ includes a valuable account of early costume. The new ascriptions are based mainly upon the evidence of the inscriptions. See also the same author's Another Śaśunaka statue in the same volume. (S. VI A. C.) A. K. C.

- Taylor, A. E.** PLATO'S biography of SOCRATES. *Proceedings of the British Academy*, 93-132, 1917-1918. ISIS

TAYLOR'S conclusion is that PLATO'S writings offer us a full and faithful portrait of his master. G. S.

S. IV A. C.

- Emmanuel, Maurice.** Le corps de l'harmonie d'après ARISTOTE. *Revue des études grecques*, t. 32, p. 179-189, 1919. ISIS

- Howald, Ernst.** Die Schriftenverzeichnisse des ARISTOTELES und des THEOPHRASTS. *Hermes*, t. 55, p. 204-221, 1920. ISIS

- Matthew, William Diller.** PLATO'S Atlantis in Palaeogeography. *Proceedings of the National Academy of Sciences*, t. 6, p. 17-18, 1920. ISIS

Scientific evidence does not lend any support whatsoever to PLATO'S Atlantis. It is a fable. G. S.

- Robin, Léon.** Études sur la signification et la place de la physique dans la philosophie de PLATON. (Extrait de la *Revue philosophique*, 1918.) 96 p. Paris, ALCAN, 1919. ISIS

S. II A. C.

- Kramrisch.** The representation of nature in early Buddhist sculpture (Bharhut and Sanchi). *Rupam*, n° 8, p. 7-10, Oct. 1921. ISIS

A somewhat searching analysis of the psychological meaning of the idioms of Indian sculpture in the second century B. C. A. K. C.

S. I A. C.

- Bellessort, André.** VIRGILE. Son œuvre et son temps, 335 p. 6^e éd., Paris, PERRIN, 1920. [Copyright 1920.] ISIS

« J'aurais atteint mon but, si ce livre contribuait à répandre et à préciser les raisons que nous avons d'admirer et d'aimer VIRGILE et de voir en lui non seulement un des plus beaux génies, mais le plus noble inspirateur de notre art, le père de notre poésie moderne, celui dont l'œuvre réfléchit déjà,

comme le bouclier d'ENÉE, toute la gloire et l'humanité de la civilisation latine. »

Birnbaum, Adalbert. VITRUVIUS und die griechische Architektur. *Denkschriften d. k. Akad. d. Wiss. in Wien, philos. hist. Kl.*, 57. Bd., 4. Abhdl., 63 p., 4 Textbild., 10 Taf. Wien, 1914. 1818

The author has tried to establish the origin of the architectural types which VITRUVIUS does not explicitly ascribe to the Greeks (this is the case for the Ionic pseudopteros, the Greek forum, house, theatre and palestra); in the second place, he has tried to determine the time and place, that is, the school of the Greek elements in VITRUVIUS' work. To realize this aim, BIRNBAUM had to reconstruct the monuments described by VITRUVIUS and to compare them with existing monuments. VITRUVIUS' materials were of Ionian origin. G. S.

Ebhardt, Bodo. Die zehn Bücher der Architektur des VITRUVIUS und ihre Herausgeber seit 1484. Mit einem Verzeichnis der vorhandenen Ausgaben mit Erläuterungen nach der Sammlung solcher im Besitz des Verfassers, 102 p., 100 ill. Berlin (Grunewald), Burgverlag. [No date, after 1915.] 1818

This very well printed and well illustrated book contains an introduction dealing with Roman architecture and VITRUVIUS' life; then an analysis of the Ten Books; finally a « *catalogue raisonné* » of the editions published from 1484 to 1915. Some of these editions are fully described. The most pleasant feature of this book is the rich collection of illustrations borrowed from many editions. The author has given us a real iconographia Vitruviana! G. S.

Schramm, E. Erläuterung der Geschützbeschreibung bei VITRUVIUS, vol. X, p. 10-12. Sitzungsberichte der preuss. Ak. d. Wiss., p. 718-734, 1917. 1818

S. I.

Jourdan, Paul. Notes de critique verbale sur SCRIBONIUS LARGUS. (*Thèse*, Neuchâtel,) 107 p. Paris, KLINCKSIECK, 1919. 1818

Les notes de critique verbale sont d'un intérêt purement philologique, et dans l'absence de manuscrit sont naturellement fort incertaines (notre plus ancien texte des « *Compositiones* » est l'édition princeps de Paris, 1529, due à JEAN DU RUEL), mais je signale cet opuscule aux historiens à cause de son introduction (bibliographie, vie et œuvre de SCRIBONIUS, éditeurs et éditions des « *Compositiones* ») et de l'appendice sur les indications de poids et mesures dans le dosage des préparations pharmaceutiques. Les « *Compositiones* » furent rédigées vers 47. G. S.

Knorr, Robert. Töpfer und Fabriken verzierter Terra-Sigillata des ersten Jahrhunderts. Mit 100 Tafeln, 52 Textbildern und chronologischer Tabelle, x+140 p. Stuttgart, W. KOHLHAMMER, 1919. 1818

Leclerc, Henri. SERVILIUS DAMOCRATE, poète polypharmaque. *Janus*, 24^e année, p. 125-134, 1919. 1818

D'origine grecque, il naquit peut-être en Asie-Mineure. Il exerça la médecine à Rome vers le milieu du I^{er} siècle. Il écrivit cinq ouvrages en vers iambiques, énumérés par GALIEN : 1^o κλινικός (*liber clinicus*), consacré à l'étude de trois médicaments; 2^o πυθικός (*liber pythicus*), traitant des drogues utilisées dans les maladies de la gorge et de la bouche; 3^o traité

des antidotes; 4^o βιβλία τῶν φαρμάκων; 5^o φιλιάρτος, compendium de vulgarisation pharmacologique. Il ne reste de ces poèmes que dix-huit fragments reproduits par GALIEN et dont trois sont ici traduits en français : L'iberis, herbe recommandée dans le traitement de la sciatique; la poudre dentifrice; le diacode, un sirop calmant, la première préparation maniable ayant pour base l'opium (διὰ κωδυῶν, κωδυά = tête de pavot). G. S.

Mock, Rudolf. Pflanzliche Arzneimittel bei DIOSKURIDES, die schon im Corpus Hippocraticum vorkommen (*Diss.*), 44 p. Tübingen, ZAUPP, 1919 (not seen). 1818

Strunz, Erich. Zahnheilkundliches in der *Naturalis Historia* des GAJUS PLINIUS SECUNDUS. (*Diss.*, SUDHOFFS Institut), 36 p. Leipzig, 1921. 1818

An elaborate compilation of everything in the *Nat. hist.* which may be of interest to the dentist. G. S.

Symes, John Elliotson. The evolution of the New Testament, XVIII+353 p. London, MURRAY, 1921. 1818

Trilk, Fritz. Die zahnärztliche Pharmakotherapie in den « Compositiones » des SCRIBONIUS LARGUS. (*Diss.*, SUDHOFF's Institut), 43 p. Leipzig, 1921. 1818

(1) Therapie der Zahnkrankheiten; (2) Therapie der Mund- und Kieferkrankheiten; (3) Blutstillung; (4) Schlafmittel. Verzeichnis der vorkommenden Arzneimittel.

« SCRIBONIUS' Therapie der Mund- und Kieferkrankheiten und die Ordinationsweise sind nach damaliger Zeit ausgezeichnet und grösstenteils durchaus rationell, mitunter sogar recht moderner Art, so dass unsere heutige wissenschaftliche Kritik gegen sie kaum etwas Ernstliches einwenden kann.

« Von den angewandten Mitteln sind viele — ich erinnere nur an Opium — fast unverändert oder in etwas anderer Form in unsern heutigen Arzneimittelschatz aufgenommen und so auch mit zu dessen Grundlagen geworden. » G. S.

Wilke, Georg. Archäologische Erläuterungen zur *Germania* des TACITUS, 84 p., 74 illustr. Leipzig, KABITZSCH, 1921. 1818

Dr. G. WILKE to whom we owe already very important prehistoric studies (published in the Mannus Bibliothek) has investigated TACITUS' *Germania* with special reference to the archaeological evidence. The result of his inquiry is a justification of the *Germania*. He considers successively the following topics: geography and natural resources of the country; external appearance of the Germans; tribes; clothing; arms; settlements and dwellings; husbandry and food: arts and crafts; commerce; customs; chronometry; religion. Many archaeological monuments are reproduced. This book will be equally useful to the student of TACITUS and to the student of European prehistory. G. S.

S. II.

Reich, Hugo. Die pseudogalenischen Schriften « de usu pharmacorum » und « de clisteribus et colica » in der Dresdner GALEN Handschrift. (*Diss.*, Leipzig, Auszug), 8 p. Leipzig 1921. 1818

Discussion of these two pseudo-Galenic treatises contained in the Dresden Latin Ms. of GALEN, Db, 92 93. G. S.

Ullrich, Friedrich. Die anatomische und vivisektorische Technik des GALENOS. (*Diss.*, Leipzig), 54 p. Werdau i. Sa., 1919. 1813

A study of GALEN's technique; material used, instruments, nomenclature; special methods of dissection for various tissues and organs; vivisection; physiological experiments. A very useful investigation. G. S.

Wessely, C. PTOLÉMÉE, géographie, IV, 5, 24 et le papyrus RAINER, n° 259. *Revue des études grecques*, t. 32, p. 504-507, 1919. 1813

S. III.

Cumont, Franz. Comment PLOTIN détourna PORPHYRE du suicide. *Revue des études grecques*, t. 32, p. 113-120, 1919. 1813

Jeanselme, E. Du tarif des denrées et des salaires sous DIOCLETIEN. Extrait de *Paris Médical*, 2 p. (sans date). 1813

S. IV.

Albertini. Table de mesures de Djemila. *Comptes rendus de l'Académie des inscriptions*, p. 315-319, 1920. 1813

Bidez, J. Le philosophe JAMBLIQUE et son école. *Revue des études grecques*, t. 32, p. 29-40, 1919. 1813

Cuq, Edouard. Une statistique de locaux affectés à l'habitation dans la Rome impériale. *Mémoires de l'Académie des Inscriptions*, t. 40, p. 279-335. Paris, 1916. 1813

Based on a document of CONSTANTINE's time, the *Notitia* (334) or *Curiosum urbis Romae regionum quatuordecim* (after 357), and especially on the following phrase: « insulae per totam urbem XLVI DCII, domus MD-CCXC ». What do the words *insula* and *domus* actually mean? According to Cuq, *insula* is not an apartment house but an apartment. It is not possible, however, to deduct the population of Rome from these figures. G. S.

Monceaux, Paul. Une invocation au « CHRISTUS medicus » sur une pierre de Tingad. *Comptes rendus de l'Académie des Inscriptions*, p. 75-83, 1920. 1812

« Subveni, CRISTE, tu sole medicus sanctis et penitentibus matrem manibus et pedibus defendentibus ». Date du IV^e siècle ou du début du V^e siècle; probablement du temps d'AUGUSTIN. G. S.

Monceaux, Paul. L'évolution intellectuelle de saint AUGUSTIN. *Journal des savants*, p. 241-253, 1920. 1818

Apropos of P. ALFARIC. L'évolution intellectuelle de saint AUGUSTIN, t. I. Paris, 1918.

Schipper, Joseph. Ein neuer Text der Gynaecia des VINDICIAN aus einer Münchener Handschrift des 12. Jahrhunderts (Cod. lat. 4622, Blatt 40-45), (*Diss.*, Leipzig), 29 p. Erlangen, 1921. 1813

This Ms. dates from the middle of the XIIIth century; it contains various texts without titles or authors' names. The VINDICIANUS text begins thus: « Omne opus medicine quod in hoc volumine contuli propter hominem describere statui », and ends: « Huic vulve collus directus positus est, cuius cervix erigitur, usque ad locum, in quo res venerio perficiuntur. » The author has added a good summary of our knowledge of VINDICIANUS.

G. S.

S. V.

Jeanselme, E. De la levée en masse au temps des Wisigoths. Insoumis et déserteurs, réformes légitimes, réformes frauduleuses. Extrait de *Paris médical*, 2 p. (sans date) 1818

Information derived from the *Leges Wisigothorum*.

G. S.

Thomas, Antoine. Une nouvelle édition de MARCELLUS de Bordeaux. *Journal des savants*, p. 15-21, 1920. 1818

A propos de « MARCELLI de medicamentis liber » Rec. MAX NIEDERMANN, xxxvi + 368 p. Leipzig, TEUBNER, 1916. G. S.

S. VI.

Haldar, A. K. The paintings of the Bagh Caves. *Rupam*, no. 8, p. 12-19, Oct. 1921. 1818

Buddhist paintings contemporary with the latest Ajanta painting (vith century); now in a very bad state of preservation. A. K. C.

Lehmann, Alfred. Die zahnärztliche Lehre des AETIOS aus Amida (*Diss.*, SUDHOFFS Institut), 48 p. Halle a. S., HENDRICHs, 1921. 1818

Einleitung. *Materia medica*. Dentition. Krankheiten der Zähne. Erkrankungen des Zahnfleisches. Abfeilen der Zähne. Exstruktion. Allgemeiner Lehrgang über Anwendung aller Mundsalben. Literatur. G. S.

Nosske, Bernhard. ALEXANDRI (TRALLIANI?) « liber de agnoscendis febribus et [= ex] pulsibus et urinis », aus dem « Breslauer Codex Salernitanus ». (*Diss.*, SUDHOFFS Institut, Leipzig), 39 p. Borna-Leipzig, R. Noske, 1919. 1818

The oldest Latin Ms. of this text (Angers) dates from the ixth century; hence a Salernitan origin is excluded, the more so that no ALEXANDER is quoted among the many doctors of the Salernitan school. Yet this text was known in Salerno, since it was included in the great Salernitan Ms. of Breslau. Then many Greek words suggest a Greek origin. If it be a Greek writing, which ALEXANDER is the author? Possibly but not certainly ALEXANDER of Tralles. The text was probably translated into Latin in South Italy sometime in the viith or viiith century. It begins thus: « Omnium causarum dum esset difficilis ratio ad praevidendum, non nullarum febrium dimensiones vel dimissiones vel imminentis spiritus impetus, qualiter ex urinarum diversitate et venarum ratio pulsu agnosci possit, arguto stilo conscripsi, non confusa ratione medicinalis inordinata quantitas querenti pernoscere fecisset cridiam ». It would be interesting to compare this text with the Paris Greek Ms. 2316 « ALEXANDRI medici opusculum de pulsuum dignotione et aphorismi de urinis ». Let us hope that this comparison may soon be made. NOSSKE gives us a list of Salernitan writings on urine. These were based essentially upon THEOPHILOS PROTOSPATARIOS (viiith century) and upon ISAAC JUDAEUS (mid. of xth century). He gives also a list of the Latin words of Greek origin in « ALEXANDER » (for ex., agmasticus, aianus, apostema, sinthexis).

G. S.

S. VII.

Heiberg, J. L. De codicibus PAULI AEGINETAE observationes. *Revue des études grecques*, t. 32, p. 268-277, 1919. 1818

S. VIII.

Abou Yousof Ya'qoub. Le livre de l'impôt foncier (*Kitāb el-Kharādji*). Traduit et annoté par E. FAGNAN (Haut-Commissariat de la République française en Syrie et au Liban. Service des antiquités et des beaux-arts. Bibliothèque archéologique et historique, I), xvi + 352 p. Paris, Paul GEUTHNER, 1921. [40 fr.] 1818

ABOU YOUSOF YA'QOUB BEN IBRĀHĪM ANĀRĪ naquit à Koufa en 113-731 et mourut en 182-798. Il fut nommé qādī à Baghdad en 166 et fut même le premier à recevoir le titre de qādī 'l-qodat, juge à compétence générale. Il était très érudit et le Fihrist lui attribue plusieurs ouvrages de droit, dont le *Kitāb el-Kharādji* seul a survécu. Cet ouvrage, dont E. FAGNAN nous donne une traduction soigneusement annotée, est une réponse aux questions posées à l'auteur par le Khalife HĀROUN ER-RECHĪD. Chaque question est résolue sur la base du Livre saint et des *Hadith*. Souvent l'auteur laisse au lecteur le soin de formuler ses propres conclusions. L'historien de la science trouvera bien peu de chose à glaner dans ce recueil. Il intéressera beaucoup, d'autre part, l'historien de la civilisation arabe et aussi l'historien du droit, car il appartient à une époque où le droit était encore bien loin d'être fixé sur beaucoup de questions. La traduction est basée sur le texte imprimé à Boulaq en 1302 H. Il y a un index copieux, d'autant plus nécessaire que la composition de cet ouvrage est assez désordonnée. Ce premier volume inaugure dignement la collection nouvelle à laquelle nous offrons tous nos vœux.

G. S.

Browne, C. A. The poem of the philosopher THEOPHRASTOS upon the sacred art. A metrical translation with comments upon the history of alchemy. *Scientific monthly*, t. 11, p. 193-214, 1920

1818

Translation of the poems published by IDLER in his *Physici et medici minores*, Berlin 1841, and ascribed to one THEOPHRASTOS CHRISTIANOS, HIEROTHEOS or ARCHELAOS who fl. in the viiith or ixth century. (See LIEPMANN, *Alchimie*, p. 108, 1919.)

G. S.

Haubold, Rudolf. Ein Münchener handschriftlicher Text angeblich des ALKINDI: « de signis astronomiae applicatis ad medicinam ». (*Diss.*, SUDHOFFS Institut), Auszug., 7 p., Leipzig 1921.

1818

Apropos of the Munich Latin Ms. 267, ff. 84r to 88r.

G. S.

Hilgen, Herbert Otto. Die abendländischen RHazes-Kommentatoren des xiv. bis xvii. Jahrhunderts. (*Diss.*, SUDHOFFS Institut), Auszug., 8 p. Leipzig, 1921.

1818

S. X.

Peine, Johannes. Die Handschrift des ISAAC JUDAEUS. (*Diss.*, SUDHOFFS Institut), 78 p. Borna-Leipzig, 1919.

1818

ABU JAKUB ISHAQ B. SOLEIMAN EL ISRA'ILI, or ISAAC JUDAEUS, was born in Egypt c. 830, where he first practised as an oculist; he died c. 932, a centenarian. His writings, highly esteemed, were translated into Latin (chiefly by CONSTANTINUS AFRICANUS) and into Hebrew. The Latin translation of his 7 main works was published in Lugd. 1515: *Opera omnia ISAACI*. PEINE gives a long list of Mss. of the *de urinis* as translated by CONSTANTINUS. The text here published is the one of the *Opera omnia* corrected by comparison with Ms. Leipzig, 1154, dating from c. 1300.

G. S.

Suter, H. Abhandlung über die Ausmessung der Parabel von IBRAHIM B. SINAN B. THĀBIT, aus dem Arabischen übersetzt und commentiert. Jahrgang 63 (1918) der *Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich*, p. 214-228. 1918

SUTER published in 1916 (*Sitzungsber. d. phys. med. Sozietät, Erlangen*, t. 48) the translation of a memoir on the measurement of the parabole by THĀBIT IBN QURRA. The memoir of which he is now offering us a translation is by THĀBIT's grandson IBRĀHIM (903-946); it is the simplest quadrature of the parabole accomplished before the invention of the integral calculus; in particular IBRĀHIM's solution is much simpler than the Archimedian. G. S.

S. XI.

Heywood, William (1857-1919). A history of Pisa in the eleventh and twelfth centuries, vi + 292 p., map, 16 ill. Cambridge, University Press, 1921. 1918

[**Ibn Yunus**]. Die Bestimmung der geographischen Breite eines Ortes durch Beobachtung der Meridianhöhe der Sonne oder mittels der Kenntnis zweier anderen Sonnenhöhen und den Zugehörigen Azimuten nach dem arabischen Text der Hākimischen Tafeln des IBN YUNUS, dargestellt von C. SHOY. *Annalen der Hydrographie und maritimen Meteorologie*, p. 3-20, 1 Tafel, Januar 1922 1918

Translation of chapters 12, 21 and of a part of chapter 11 of the IBN YUNUS' astronomical tables (*zigh*), with notes. G. S.

Renauld, Emile. Lexique choisi de PSELLOS. Contribution à la lexicographie byzantine, xxvii + 160 p. Paris, PICARD, 1920. 1918

Il suffit de mentionner cet ouvrage, le premier lexique spécial de MICHEL PSELLOS; il rendra service aux étudiants de la science byzantine. Le lexique est précédé de notes bibliographiques relatives à PSELLOS, à son œuvre, la littérature et la lexicographie byzantines. G. S.

Resak, Cyrill. ODO MAGDUNENSIS, der Verfasser des « Macer Floridus » und der deutsche Leipziger Macer text. (*Diss.*, SUDHOFFS Institut), 49 p. Borna-Leipzig, 1917. 1918

The « Macer Floridus de virtutibus (or de viribus) herbarum » is a Medieval poem describing in 2269 hexameters the medical properties of 77 herbs and roots. A separate section is devoted to each plant. There are 20 more chapters (487 verses) which are apparently a later addition. This Herbal is based upon PLINY, DIOSCORIDES, GALEN, OREIBASIIUS, GARGILIUS MARTIALIS, PALLADIUS, CONSTANTINUS AFRICANUS. It is impossible to determine the authorship and date of this poem with any certainty, but the most probable date is the end of the xith century, soon after CONSTANTINUS, who fl. 1060-1087. The only author's name distinctly transmitted in the Mss. is ODO MAGDUNENSIS (ODON DE MEUNG sur Loire). It seems that this poem was twice translated into German, in the xiiith and in the xivth century; many Mss. of these translations exist. One of them (Leipzig University Library, n° 1129) is here edited; it is a fragment and refers to only 35 plants. G. S.

S. XII.

Anschütz, Willy. Zwei Fieberschriften des « Breslauer Codex Salernitanus » und die « Fieberlehre der Schule von Salerno » (*Diss.*, Leipzig), 44 p., Leipzig, NOSKE, 1919. 1918

The great Salernitan manuscript of Breslau contains two treatises dealing with fever: a larger one beginning « Febris est calor innaturalis » and a

smaller one, " *Febris est calor accensus in corde ultra naturam* ". ANSCHÜTZ studies both treatises in their relation to other Salernitan writings and publishes the smaller one (less than 3 printed pages). Index of fever terminology in Latin and Greek. G. S.

[**Berachya Hanakdan**]. *Dodi ve-nechdi* (Uncle and Nephew). Now edited from Mss. at Munich and Oxford with an English translation, introduction, etc., to which is added the first English translation from the Latin of ADELARD OF BATH's *Quaestiones Naturales* by HERMANN GOLLANCZ. XXII + 161 + 59 p. Oxford University Press, 1920. 1918

ADELARD's Uncle and Nephew dialogue on all sorts of " natural questions " is divided into 76 chapters each dealing with one question. I quote the titles of the 7 chapters numbered 1, 11, 21..., 71 as samples : Why do plants grow without any previous sowing of seed?; why some animals have a stomach and others not? how do we hear sounds that reach us?; the nature of smell, taste and touch; why if you have intercourse with a woman after she has lain with a leper, you will catch the disease while she will escape; why sea-water is salt; whether when one atom is moved, all are moved, since whatever is in a state of motion moves something else, thus setting up infinite motion; why the planets and, above all, the sun do not keep to their course through the middle of the aplanos without deviation. This book was written by ADELARD upon his return to England, in the reign of HENRY I (1068-1135) and contains the fruits of his Arabian learning. BERACHYA's *Dodi Venechdi* is a sort of free translation of it. It was thus an excellent idea to publish both texts together. It would be worth while to undertake a critical and comparative study of both from our point of view. BERECHIAH HA-NAQDAN (= BENEDICTUS le Puncteur?) is an English Jew who fl. at the end of the 11th century; he is known chiefly as the author of a set of fox fables (see *Jewish Encyclopedia*, t. 3, p. 53-55, 1902, JOSEPH JACOBS). G. S.

Buerschapper, Rudolf. Ein bisher unbekannter Aderlasstraktat des Salernitaner Arztes MAURUS : de flebotomia. (*Diss.*, Sudhoffs Institut., 38 p. Borna-Leipzig. Noske, 1919. 1918

MAURUS was one of the most famous teachers of Salerno; he flourished c. 1160, that is, about the end of the golden period of this school. The *Flebotomia MAURI* (or *MARI*) is here edited for the first time from two Mss. : Dresden Db 91 and Brussels 14324-14343. Both texts are published *in extenso* in parallel columns, and are followed by a free translation and commentary. G. S.

Czarnecki, R. Ein Aderlasstraktat angeblich des ROGER von Salerno samt einem lateinischen und einem griechischen Texte zur « *Phlebotomia HIPPOCRATIS* ». (*Diss.*, Leipzig), Borna-Leipzig, R. Noske, 1919. 1918

Republication of the « *de modis mittendi sanguinem et de cuiusque utilitate ROGERII chirurgi peritissimi libellus* », first published in the Bale edition of ALBUCAZIS, 1541 (see title page in Sudhoff's *Beiträge zur Geschichte der Chirurgie im Mittelalter*, II, 17, 1918). CZARNECKI concludes that ROGER, the father of Italian surgery, who fl. in Salerno c. 1170, was not the author of this phlebotomy. Two other similar treatises are edited in the appendix : an « *epistula de fleutomia* » which may date from the xth or the ixth cent. (LAURENT., *Pluteus LXXXIII*, *Col. 11*) : a Greek text (Vienna, *Col. Graec.* 16). περί φλεβοτομίας Ἱπποκράτους χρηρὲς γινώσκειν ὅτι τοὺς παῖδας οὐ φλεβοτομῆν ἀρχὴ ἐστὶν ἰδ.. *Explicit* : δεῖ τοὺς ποδαρτικούς ἀπ' ἀρκυνος φλεβοτομεῖν ἐπιληπτικούς δε καὶ σκοτοματικούς ἀπο τῶν σκελῶν μόνον. G. S.

Erchenbrecher, Hans. Der Salernitaner Arzt ARCHIMATTHAEUS und ein bis heute unbekannter Aderlasstraktat unter seinem Namen. (*Cod. berol. lat.* 4^o, 257). (*Diss.*, SUDHOFFS Institut), Leipzig, 1919 (not seen). 1818

Haskins, Charles H. The Greek element in the Renaissance of the xiiith century. *American historical review*, vol. 25, p. 603-615, 1920. 1818

A survey of the present state of knowledge on the Greek Renaissance which took place in the xiiith cent. chiefly in Sicily. The Greek learning came in a large measure through Arabic intermediaries, but there was also a direct contact with Greek sources. As Prof. HASKINS' studies have contributed much to make this clear, he was fully qualified to prepare this survey, which is very full and gives all the necessary references. It is significant that this early Greek Renaissance was not concerned with the classical works of literature and history, but rather with medicine, mathematics, philosophy and theology. It is not yet possible to establish completely the continuity between this xiiith cent. Renaissance and the Greek revival of the Quattrocento. In my opinion this is due to the fact that scholars have been so exclusively concerned with the literary and artistic Renaissance that they have not seen the scientific Renaissance which took place at the same time. Let us hope that many students may be tempted to pursue investigations along HASKINS' line. G. S.

Jeanselme, E. et Oeconomus, L. Les œuvres d'assistance et les hôpitaux byzantins au siècle des Comnènes. Communication faite au 1^{er} Congrès de l'Histoire de l'art de guérir, Anvers, 1920; 20 p., 1921. 1818

Cette étude est basée sur les sources byzantines; elle est précédée d'une brève histoire des institutions, charitables et hospitalières, depuis les premiers siècles de notre ère, c'est-à-dire depuis leur origine, car l'antiquité païenne méconnut toujours le devoir d'assistance. G. S.

Jeanselme, E. et Oeconomus, L. Où il est établi que THÉODORE PRODRÔME fut atteint de la variole. Communication faite au 1^{er} Congrès de l'Histoire de l'art de guérir, Anvers, 1920; 3 p., 1921. 1818

Le poète THÉODORE PRODRÔME florissait à Byzance sous le règne de JEAN COMNÈNE (1118-1143). Il a décrit une grave maladie pestilentielle (λοιμωξίς) dont il pensa mourir. Les auteurs montrent que cette maladie n'était autre que la variole (décrite exactement dès le ix^e siècle par RAZÈS). G. S.

Kilian, Kurt. Kur und Diätetik von Nierensteinen nach dem « Breslauer Codex Salernitanus » herausgegeben (im Drucke gekürzt). (*Diss.*, SUDHOFFS Institut), 16 p. Leipzig, 1920. 1818

With the text : « Contra harenulas in renibus et collectionem humorum in eisdem et dispositionem ad melancholiam et repletionem stomachi », notes and bibliography. G. S.

Kroemer, Georg Heinrich. JOHANNES VON SANCTO PAULO « Liber de simplicium medicinarum virtutibus » und ein anderer Salernitaner Traktat : « quae medicinae pro quibus morbis donandae sunt », nach dem « Breslauer Codex » herausgegeben. (*Diss.*, SUDHOFFS Institut, Leipzig), 86 p. Borna-Leipzig, 1920. 1818

KROEMER has used not simply the Breslau Ms. but many others as well, and a printed edition in the *Opera* YSAAC, Lugduni 1515, wherein it is wrongly ascribed to CONSTANTINUS AFRICANUS. Of the real author, JOH. DE SANCTO PAULO, we know hardly anything. But as the Breslau Ms. was

written c. 1160-1170, if JOH. DE SANCTO PAULO be the author of this treatise he must have flourished at no later time than the third quarter of the xiith cent. Many other writings are ascribed to him. In the Breslau Ms., the « quae medicinae » follows immediately the former text. It is here published for the first time. It is a collection of medical and chemical short recipes; the first : « pro dolore capitis ex flegmate vel melancholia datur »; the last : « ad faciendum album saponem ad solem vel ad ignem ». This publication ends with an elaborate bibliography and a dietetic-culinary-medical-pharmacological glossary. G. S.

Langebartels, Erich. Zahnheilkunde und Kieferchirurgie in der chirurgischen Literature von Salerno, und der weiteren ROGER-Glosse unter Mitherausgabe der zahnheilkundlichen ROGER-Marginalien im Codex Amplonianus 62a in 8°. (*Diss.*), 63 p. Leipzig, 1919 (not seen). 1918

Maske, Erich. Der Münchner Codex latinus 4622 und sein medizinischer Inhalt (Auszug, *Diss.*, SUDHOFFS Institut), 16 p. Druck von AUGUST OBERREUTER in Zeulenroda, Thür. [n. d., received in 1921]. 1918

This Ms. of the State Library in München is an encyclopaedic miscellany of 179 leaves of which p. 35r to 80v deal with medicine. It dates from the xiith cent. Its medical contents are analyzed, a few extracts quoted with brief commentary and a bibliography. G. S.

Matthaes, Curt. Der Salernitaner Arzt Urso aus der 2. Hälfte des 12. Jahrhunderts und seine beiden Schriften « de effectibus qualitatum » und « de effectibus medicinarum ». (*Diss.*, SUDHOFFS Institut, Leipzig), 74 p. Borna-Leipzig, R. NOSKE, 1918. 1918

These two texts had apparently not yet been published. Many Mss. of the former exist. MATTHAES' edition is chiefly based upon the Erfurt Ms., 215 of the beginning of the xivth cent. « *Incipit* : Cum quaestionum fere omnium solutiones a qualitatum effectibus sua videantur ducere principia, dignum duxi, earum effectus, quos tum ex se, tum ex subiectorum naturis consequuntur, exponere ». The author knows only two Mss. of the latter text (Erfurt, AMPLON. 204, in-4°; Berlin, Ms. lat. quart. 375) and has used them both. In both Mss. the second text is the sequel of the first. « *Incipit* : Quoniam in superiori tractatu de effectibus qualitatum prout divina dispensatio nobis infudere egimus, ergo in subsequenti opere quaedam necessaria ad cognitionem curarum egritudinum et morborum curationes dicere proposuimus »... We know very little of this Urso; he taught in Salerno in the second half of the xiith cent. and was the master of ARGENTIUS of Corbeil. GIACOSA published another writing of his, *de urinis*. G. S.

[al-Nizāmi a'-'Arudī] The Chahar Maqala of NIZĀMI-I-'ARŪPI translated by EDWARD G. BROWNE (GIBB Memorial series, vol. XI, p. 2). Leyden, 1921. 1918

A revised translation of the Four discourses of AL-NIZĀMI, with abridged translation of the notes to the Persian edition (Leyden 1910) contributed by MİRZĀ MUHAMMAD IBN 'ABDU'L-WAHHĀB of Qazwin. The first translation appeared in the *Journal of the R. Asiatic Soc.*, July and Oct. 1899 (reprint, 140 p.). G. S.

Ostermuth, Hermann Johannes. « Flores Diaetarum ». Eine salernitanische Nahrungsmitteldiätetik aus dem xii. Jahrhundert verfasst vermutlich von JOHANNES DE SANCTO PAULO. (Institut für Geschichte der Medizin; *Diss.*), 58 + xii p. Leipzig, 1919. 1918

This text had already been published in the complete works of BERNARD

DE GORDON, Lyon 1574. The latter was professor of medicine in Montpellier in 1285; he is certainly not the author of the "flores". The new text is based upon 4 Mss. of AMPLONIUS' collection (Erfurt); SCHUM in his catal. of the Cod. Ampl. (Berlin 1887) had wrongly attributed the text of these 4 Mss. to ARNOLD OF VILLANOVA. OSTERMUTH has examined also various other Mss. Technical glossary and bibliography. G. S.

Ploss, Werner Ludwig Heinrich. Anatomia MAURI, eine bisher unbekannte salernitaner Skizze vom Bau des Menschen auf Grundlage einer Zergliederung des Tierkörpers, herausgegeben nach einer weiland Heidelberger Handschrift des 12. Jahrh. im Vatikan zu Rom (Pal. lat. 1097, Bl. 122). Diss., SUDHOFFS Institut), 14 p. Leipzig, 1921. 1816

Mag. MAURUS fl. c. 1160, that is, about the end of the best period of Salernitan medicine. We have quite a few anatomical treatises of that period. Salernitan anatomy was based upon the dissection of animals, chiefly pigs; this was of course a considerable progress upon mere book knowledge. The first human dissections of the middle ages occurred probably in Bologna about and after 1250. The Ms. from which the text of the *Anathomia* MAURI is reproduced dates from the second half of the thirteenth century G. S.

Reinhardt, Hellmuth. Ein Tractat über Arzneiwässer nach ihren Wirkungen zusammengestellt aus dem « Breslauer Codex Salernitanus » zum ersten Male und mit dem Texte eines Codex aus der Biblioteca Angelica zu Rom verglichen. (Diss., Leipzig, Auszug), 23 p., Freiberg i. Sa., 1921. 1815

One more study devoted to the famous Codex Salernitanus discovered in Breslau, 1837, by HENSCHEL. GIACOSA had assumed that this Ms. and the Codex Angelicus were substantially the same. A comparison of the chapter "de aquis medicinalibus et earum differentiis" reveals many differences; e. g. medicinal waters mentioned in one are not mentioned in the other and *vice-versa*. Yet it is very likely that these two Mss. are simply the results of notes taken by different medical students either the same year or at a short interval. It is easy to conceive that the professor would not necessarily speak every year of the same waters. The Codex Salernitanus contains no mention of "aqua ardens". Alcohol became known only c. 1160-1170, in S. Italy. G. S.

Riesch, Helene. Die heilige HILDEGARD von Bingen (Frauenbilder) 2te verbesserte Auflage, VIII + 160 p., 2 pl. Freiburg i. Br., HERDER, 1920. 1815

A popular but comprehensive account of the life and works of HILDEGARD, first published in 1917. For the preparation of this new edition the author has availed herself of ROTH's investigations (1918; *Isis*, IV, 403), but she does not know SINGER's work (1917). Only a few pages of the last chapter (139-143) deal with HILDEGARD's scientific work. G. S.

S. XIII

Huart, Cl. SAADI, poète persan. *Journal des savants*, p. 253-262, 1920. 1818

Apropos of HENRI MASSÉ, *Essai sur le poète SAADI*. Paris, GEUTHNER, 1919. G. S.

Jansen, B. (S. J.). OLIVI der älteste scholastische Vertreter des heutigen Bewegungsbegriffs. *Philosophisches Jahrbuch der Görres-Gesellschaft*, t. 33, p. 137-152. Fulda, 1920. 1818

Important contribution to our knowledge of medieval mechanics. PETRUS

JOH. OLIVI (1248 or 1249 to 1298) was one of the earliest authors to explain clearly the theory of the impetus (cfr. PHILOPONUS, viith and MICHAEL SCOT, xiith cent.). To use FATHER JANSEN's own words, « Das Entscheidende und Moderne in seiner Bewegungslehre ist demnach, dass er die sogenannte gewaltsame Bewegung im Sinne des heutigen Kraftbegriffes und des Trägheitsgesetzes erklärte, indem er sie auf einen inneren Bewegungszustand zurückführte, der, durch die Einwirkung des Bewegers hervorgerufen, unabhängig von dessen weiterer Einwirkung in bewegten Körper beharrt ».

G. S.

Linge, Waldemar. Die Bologneser ROGER-Glosse des ROLANDO CAPELLUTI aus Parma. (*Diss.*, SUDHOFFS Institut), 33 p., Borna-Leipzig, 1918.
R. NOSKE, 1919.

ROLANDO CAPELLUTI, born in Parma, was professor of surgery at Bologna about the middle of the xiith cent. His main work, the *Chirurgia Rolandina*, is more than a mere commentary of the surgery of RUGGIERO DA PALERMO, yet it can not be considered as an original work. The author has compared both works, ROLANDO's as printed in the *Collectio chirurgica*, Venice 1513, 135-146 and RUGGIERO's in SUDHOFF's edition, in his « Beiträge zur Gesch. d. Chirurgie im Mittelalter », vol II, p. 156-236, 1918. He concludes that the importance of ROLANDO's commentary has been exaggerated.

G. S.

Mehner, Moritz Arndt. JOHANNE VON PARMA und seine Practicella. (*Diss.*, SUDHOFFS Institut), 41 p., Borna-Leipzig, 1918.

This GIOVANNI DA PARMA is not the one quoted by PANSIER (*Janus*, 1909, 423) who fl. in Avignon in the second half of the xiith cent., nor any of the many JEAN DE PARME enumerated in CHEVALIER's Répertoire, but rather a Franciscan named by FABRICIUS in his « Bibliotheca latina mediae aetatis », who fl. about and after 1250. The author has studied 19 Mss. of the Practicella (and there are still many others), the oldest dating from the end of the xiith cent. The text is reproduced from Ms. Leipzig 1209, which dates from the end of the following century.

G. S.

Querfeld, Arthur Heinrich. MICHAEL SCOTTUS und seine Schrift « de secretis naturae ». (*Diss.*, Leipzig). Aus dem Institut für Geschichte der Medizin, 66 p., Leipzig, 1919.

Study based upon the Ambrosiana Ms. L 92 sup. fol. 89r-135r dating from 1256. This Ms. can not be much younger than the composition itself for we know that MICHAEL SCOT was still alive in 1250. QUERFELD quotes a few extracts of the « de secretis naturae » and analyzes the whole work.

G. S.

Schaarschmidt, Franz Otto. Die Anatomie des WILHELM VON SALICETO. (*Diss.*, Leipzig), 75 p., Borna-Leipzig, ROBERT NOSKE, 1919.

Many studies have already been devoted to WILLIAM OF SALICETO (GRUNOW 1895, etc.) but more attention has been paid to his medical activity than to his anatomy. He was born c. 1210 in Saliceto near Piacenza (hence the surname Placentinus). He studied and taught in Bologna and LANFRANC was one of his pupils. He wrote a *Chirurgia* in 1269-1275, then his *Summa conservationis et curationis* and died in 1276-1280 in Verona or Piacenza. The anatomy was printed twice in Venice 1489, 1546. The new text is edited from Cod. Lips. 1177, dating from 1471, and is followed by an elaborate analysis and bibliography. G. S.

Wiedemann, Eilhard und Hauser, Fritz. Über die Uhren im Bereich der islamischen Kultur *Nova Acta*, Bd. 100, p. 272, Halle, 1915.

See under *Islam*.

1818

Witte, J. Das Buch des MARCO POLO als Quelle für die Religionsgeschichte, 126 p. Berlin, HUTTEN [1916]. 1818

Reviewed by FR. JÄGER in *Ostasiatische Z.*, t. 7, p. 253.

S. XIV.

Arensberg, Walter. The cryptography of DANTE, XI + 494 p. New-York, KNOPF, 1921. 1818

Another unwelcome addition to cryptographic literature. The author's special form of the cryptographic disease is aggravated by the addition of Freudian psychology. He is already preparing another volume on « The symbolism of the *Divina Commedia* » in which he proposes to develop « the interpretation of the sex symbolism not only of the *Commedia* and of Christian theology but also of myths and dreams in general » (!).

G. S.

Carbonelli, G. e Ravasini, R. Commenti sopra alcune miniature e pitture italiane a soggetto medico specialmente dell' arte d'illustrare il « Tacuinum Sanitatis » nei sec. XIV e XV colle referenze ad alcune pitture murali, 80 p., 52 pl., Roma, F. CENTENARI, 1918. 1818

Daffner, Hugo (editor). Deutsches DANTE-Jahrbuch. Sechster Band. 167 p. Jena, DIEDERICH, 1921. 1818

The following papers of the sixth annual volume of the German DANTE society are of special interest to us : FRANZ KAMPERS. DANTES Beziehungen zur Gnosis und Kabbala; WILHELM SCHERER. DANTES pädagogische Bedeutung; H. DAFFNER. Bücherschau. G. S.

[Dante]. Omaggio dell'Olanda. L'Aia, NYHOFF, 1921. 1818

[Dante]. Essays in Commemoration. University of London Press, 1921. 1818

Dyroff, Adolf. DANTE und PIETRO D'ABANO. *Philosophisches Jahrbuch der Görres-Gesellschaft*, t. 33, p. 253-271, Fulda, 1920. 1818

Fisher, A. BATTŪTA, nicht BATŪTA. *Z. d. deutschen morgenl. Gesell.*, t. 72, 289, 1918. 1818

Grierson, G. A. and Barnett, L. D. Lallā Vākyāni, or wise sayings of the mystic poetess LAL DEB, 225 p., London. Royal Asiatic Soc. 1920. 1818

Mystical poems of the well known Kāshmirī poetess of the XIV century, in the tradition of Kashmir Saivism. With linguistic notes and vocabulary by GRIERSON and a disquisition on Yoga by BARNETT. A. K. C.

Jourdain, Philip E. B. The logical significance of « OCKHAM'S RAZOR ». *The Monist*, t. 29, p. 450-451, 1919. 1818

« The principle of parcimony appears, from a logical point of view, to be simply the maxim that logical analysis is to be carried as far as possible; and this is no more than DEDEKIND's maxim that what *can* be proved *is* to be proved ». G. S.

Lazzari, G. L'année de DANTE. *Mercure de France*, Paris, t. 152, p. 644-659, 15 déc. 1921. 1818

Revue des éditions de DANTE ALIGHIERI publiées à l'occasion du VI^e centenaire de sa mort, et des très nombreux travaux parus en Italie en commémoration de cet événement. L. G.

Lindsay, James. The logic and metaphysics of OCCAM. *The Monist*, t. 30, p. 521-547, 1920. 1818

Lippmann, Edmund O. von. Das Sammelbuch des VITALIS DE FURNO und seine Bedeutung für die Geschichte der Chemie. *Chemiker-Zeitung*, Nr. 3 (reprint, 17 p.), 1922. 1818

A study from the chemical point of view of the *Pro conservanda sanitate*, a pharmacological collection compiled by VITALIS DE FURNO, (or Vital du Four, from Four in Brittany) Franciscan friar, Cardinal in 1312, Bishop of Albano 1321, died in Avignon 1327. It is divided as follows: water and its varieties; metals; other anorganic substances; substances derived from plants; from animals. This collection was very antiquated, its sources being largely ancient, patristic or early Muslim (not further down than 1150 or even 1100). G. S.

Lippmann, Edmund O. von. Chemisches und Technologisches bei DANTE. *Chemiker Zeitung*, Nr. 113 (Reprint, 5 p.), 1921. 1818

Mather, Frank Jewett, The portraits of DANTE, compared with the measurements of his skull and reclassified (Princeton monographs in art and archaeology, X), xiv + 85 p., 66 illustr. Princeton University Press, 1921. 1818

Passerini, Conte Giuseppe Lando (1858-). DANTE. Note biografiche e storiche. Milano, R. CADDEO, 1921. 1818

Waxman, Meyer. The philosophy of Don HASDAI CRESCAS. (Columbia University Oriental Studies. vol. 17), xii + 162 p. New York, Columbia University Press, 1920. 1818

HASDAI BEN ABRAHAM CRESCAS, born in Barcelona 1340 - d. 1410. He belonged to one of the noblest and wealthiest families of the Catalanian Jewry. He was a great scholar, bold enough to oppose the Aristotelian doctrines even in the Jewish garb which MAIMONIDES had given to them. His main work is the *Or Adonai* (in Hebrew, "the Light of the Lord") containing his theological views; he wrote also (in Castilian) a polemical treatise against Christianity. Influential at the court of Arragon, he was nevertheless cast into prison as suspect of sharing in some conspiracy. His only son was killed during the terrible persecution of 1391. Thereupon he removed to Saragossa where the rest of his life was spent in philosophic study. WAXMAN analyzes his theological and philosophical views and compares them with those of MAIMONIDES and SPINOZA. G. S.

S. XV.

Cronau, Rudolf. The discovery of America and the landfall of COLUMBUS. The last resting place of COLUMBUS. Two monographs, based on personal investigations, 90 p., 35 illustr. Published by R. CRONAU. 340 East 198th st., New-York, 1921. [300 copies]. 1818

English edition of the results already published by the author in German: *Amerika, die Geschichte seiner Entdeckung*, 2 vol., Leipzig. 1892 (also Spanish transl., Barcelona 1892). The conclusions of each essay are: 1. Watling's Island is the Guanahani island where COLUMBUS landed on Oct. 13, 1492. It is the only island of the Bahama archipelago that corresponds at all to COLUMBUS' description; 2. The last resting place of COLUMBUS is in the cathedral of Santo Domingo. — Both arguments seem conclusive. G. S.

Davis, Tenney L. *The Text of Alchemy and the Songe Verd. The Monist*, t. 30, p. 70-106, 1920. 1818

Translation of the *Songe-Verd*, from the French edition of Paris 1695, wherein this text is ascribed to one TREVISAN. This is probably the famous alchemist BERNHARDUS TREVISANUS (not to be mistaken with two later namesakes!), born at Padua 1406 - died 1490? According to SCHMIEDER 1832, this TREVISAN wrote originally in French? DAVIS does not bring any new light on this question, and he could not for he only refers to HOFER's *Histoire de la Chimie*, and A. E. WHITE's *Lives of alchemystal philosophers!!*, — two books which should never be used. He would have done better to consult FERGUSON's *Bibliotheca Chemica*, 1906, vol. I, p. 100-104; vol. II, p. 389, 466-467. G. S.

Vignaud. *Lettre à l'académie. Comptes rendus de l'académie des inscriptions*, p. 153-162, 1920. 1818

Résumé des conclusions de son dernier ouvrage : *The Columbian tradition on the discovery of America*. COLOMB n'a pas découvert l'Amérique en s'efforçant de se rendre aux Indes et TOSCANELLI ne fut pour rien dans sa découverte. G. S.

Zehl, Curt Alfred. *Der humanistische Arzt Dr. ERHARD WINSBERGER (Ventimontanus Aeolides), Professor in Ingolstadt, und seine literarische Betätigung. (Diss., Leipzig)*, 56 p. Borna-Leipzig, R. NOSKE, 1919. 1818

The university of Ingolstadt was solemnly inaugurated in 1472. Magister ERHARDUS VENTIMONTANUS became professor of medicine in 1476, and later he began to teach poetry (Poetria) as well as medicine! Little is known of his life. He was born in Bale and was a student in Paris from 1472 to 1475. ZEHL edits and studies some of his MSS. writings ("Recepta concordiae pro dominis doctoribus medicis Nurembergensibus; Consilium for WILHELM VON EICHSTÄDT, 1480; consilium in tinnitu aurium cum diminutione auditus, etc. "). G. S.

Broek, A. J. P. v. d. *Einiges über Harn- und Geschlechtsorgane im besonderen über das Koitusbild in der Anatomie des LEONARDO DA VINCI. Janus*, 24^e année, p. 85-100, 1919. 1818

S. XVI.

[**Bābur**]. *Memoirs of ZEHİR-ED-DİN-MUHAMMED BĀBUR, Emperor of Hindustan (1483-1530) in the Chaghatai Tūrki and translated by JOHN LEYDEN and WILLIAM ERSKINE, annotated and revised by Sir LUCAS KING*, 2 vol., cxii + 324; viii + 472 p. Oxford University Press, 1921. 1818

[**Barbosa, Duarte**]. *The book of DUARTE BARBOSA. An account of the countries bordering on the Indian Ocean and their inhabitants, written by DUARTE BARBOSA and completed about the year 1518 A. D. Translated from the Portuguese by MANSEL LONGWORTH DAMES*, 2 vol. (HAKLUYT Society, Second series, n^{os} 44, 49). London, 1918-1921. 1818

BARBOSA was in the service of the Portuguese government in India from c. 1500 to c. 1516. His work was long known only through the Italian version of it included in RAMUSIO's *Navigazioni e Viaggi*, Venice 1563, etc. An English translation was made from a Spanish MS. version by Lord STAN-

LEY and published by the HAKLUYT Society in 1865. The Portuguese text was not published until 1812 or 1813, by the Royal Academy of Sciences at Lisbon. BARBOSA's sister, BEATRIZ, married FERNÃO DE MAGALHÃES. BARBOSA joined his brother-in-law's great expedition in 1519; he was the latter's mainstay at the most critical point of his voyage, the mutiny at Porto de São Juhão on April 2, 1520. After the death of MAGALHÃES at the Isle of Mactan, Philippines, on April 21, 1521, BARBOSA tried without result to recover possession of his body. He was murdered himself a few days later, on May 1, by order of the King of Sebu. The value of BARBOSA's work is chiefly geographical and ethnographical. "His accounts are extremely accurate in many respects, and show great powers of observation. This applies more especially to the S. of India, where his long residence and his knowledge of one at least of the languages gave him an understanding of the people, of which we find few traces among the writers of that period." Elaborate bibliography, introduction, notes and index. G. S.

Bosmans, H. Les derniers travaux sur JEAN TAISNIEU d'Ath. *Revue des questions scientifiques*, 4 p. octobre 1921. 1818

Analyse de travaux récents (par J. DEWERT, 1913; M. SOONS, 1913; L. GODEAUX, 1914-1915) sur JEAN TAISNIEU, médecin, mathématicien, musicien, né à Ath en 1508. Son *opus mathematicum* était en grande partie consacré à la chiromancie. C'était un personnage singulier, mais d'ordre secondaire. G. S.

Bruck, Walther. Die Historie vom güldenem Zahn eines schlesischen Knaben, 1593. (Kulturgeschichte der Zahlheilkunde, hrg. v. KURT PROSKAUER, 3) 42 p. Berlin, HERMANN MEUSSER, 1920. 1818

This is the history of the first golden tooth-crown in Germany. This crown of a Silesian boy attracted so much attention that a not inconsiderable literature was soon devoted to it. From the bibliography given by BRUCK, I gather that not less than 11 publications dealing with it appeared between 1595 and 1600. The result of the investigation is that it was not a genuine prosthetic crown but a clever fraud, the idea being to make people believe that this golden tooth had grown like the others! BRUCK's story is based upon the early documents, chiefly upon JAKOB HORST's commentary: "De aureo dente maxillari pueri Silesii, primum, utrum ejus generatio naturalis fuerit, necne; deinde an digna ejus interpretatio dari queat. Lipsie, 1595. Many extracts from this and other early publications (e. g. poems celebrating this wonder tooth) are given. This book is equally interesting for the historian of superstition and the historian of dentistry. G. S.

Dehétrain, Henri. L'œuvre des géographes normands aux XVI^e et XVII^e siècles. *Journal des Savants*, p., 21-32, 1920. 1818

Apropos of ANTHIAUME. Cartes marines, constructions navales, voyages de découverte chez les Normands, 1500-1650, 2 vol. Paris, 1916 (*I*er, III, 134; IV, 52). G. S.

Ferrand, G. Les poids, mesures et monnaies des mers du Sud aux XVI^e et XVII^e siècles. *Journal asiatique*, t. 16, p. 5-150, p. 193-312, 1920. 1818

L'ANCIENNE ROUTE DES ÉPIQUES D'APRÈS BARROSA (1553); CANTANEDA (1552) et ALBUQUERQUE (1513); Livre des poids, mesures et monnaies de ANTONIO NUNEZ (1554); Livre des monnaies, poids et mesures de SPARR DE HOMBERG (1681); prix de certaines denrées à Cananor en 1508; extrait du Livre de DUARTE BARROSA (1516-1518); souvenirs des affaires de l'Inde

en 1525; extrait des *Ayn-i-Akbari* (1595); Deux tarifs des douanes de Salcete; tarif de 1619, tarif de Siva Poy; monnaies, poids et mesures du golfe de Bengale; table de concordance des poids de l'Inde, des anciens poids portugais et du système métrique; table de réduction au système métrique des mesures de capacité qui étaient en usage dans l'Inde; table d'équivalence en reis portugais des anciennes monnaies de l'Inde; index géographique; glossaire de quelques noms de monnaies, poids et mesures; index des monnaies, des poids, des mesures de capacité et de longueur.
G. S.

Firth, Charles H. Sir WALTER RALEIGH's history of the world. *Proceedings of the British Academy*, p. 427-446, 1917-1918. 1818

"I venerate", said Lord ACTON in one of his letters (1869) "that villainous adventurer, for his views on universal history." This history was written in the beginning of the XVIIIth cent., but Raleigh was a man of the XVIIth.
G. S.

Franklin, Alfred. Paris et les Parisiens au XVI^e siècle. Paris, EMILE PAUL, c. 1921 [not seen]. 1818

Gentile, Giovanni. GIORDANO BRUNO e il pensiero del rinascimento. Florence, Vallecchi, c. 1921 [not seen]. 1818

IJzerman, J. W. DIRCK GERRITSZ POMP alias DIRCK GERRITSZ CHINA. De eerste Nederlander die China en Japan bezocht (1544-1604). Zijn reis naar en verblijf in Zuid-Amerika, grootendeels naar Spaansche bescheiden bewerkt, XXII + 195 p., 2 kaarten, LINSCHOTEN-Vereeniging, IX). 's Gravenhage, MARTINUS NIJHOFF, 1915. 1818

James, M. R. Lists of manuscripts formerly owned by Dr. JOHN DEE [1527-1608] with preface and identifications. (Supplement to the *Bibliographical society transactions*, n° 1), 40 p. Oxford University Press, 1921. 1818

[**Linschoten, Jan Huyghen van**]. Reizen van JAN HUYGHEN VAN LINSCHOTEN naar het Noorden (1594-1595), uitgegeven door S. P. L'HONORÉ NABER, LXXXIV + 308 bdz., 18 kaarten en platen (LINSCHOTEN-Vereeniging, VIII) 's Gravenhage, M. NIJHOFF, 1914. 1818

Travels to the Kola peninsula, the Barents sea, Nova Zembla, etc. G. S.

Lippmann, Edmund O. von Zur Geschichte des Alkohols. *Chemiker-Zeitung*, 1922, Nr. 1 (Reprint, 2 p.). 1818

The discovery of alcoholic distillation which occurred probably in S. Italy in the XIth [or XIIth] cent. was necessarily connected with the improvement of the refrigerating process. LIPPMANN has derived some additional information on the latter subject from ABU'L-FAZL ALLAMI'S *Ain-i-Akbari* (the Government of Akbar, 1556-1605).
G. S.

[**Lodewycksz, Willem**]. De eerste schipvaart der Nederlanders naar Oost-Indië onder CORNELIS DE HOUTMAN, 1595-1597. Journalen, documenten en andere bescheiden uitgegeven en toegelicht door G. P. ROUFFAER en J. W. IJZERMAN. I. D'eerste boeck van WILLEM LODEWYCKSZ. (LINSCHOTEN-Vereeniging, 7), XXXIV + 248 bdz., titelplaat, 2 portretten, 8 kaarten en 47 platen. 's Gravenhage, M. NIJHOFF, 1915. 1818

Annotated reprint of the first edition of the D'eerste Boeck. *Historie*

van Indiën waerinne verhaelt is de avontueren die de hollandsche schepen bejeghent zijn..., door G. M. A. W. L. Amsterdam, 1598. G. S.

Meissner, Richard. Eine deutsche Apotheke des xvi. Jahrhunderts. Dargestellt auf Grund einer notariell beglaubigten und bei dem Verkaufe der Rathsapotheke zu Kolberg im Jahre 1589 aufgestellten Inventurliste, 397 p. Leipzig, Akademische Verlagsgesellschaft, c. 1920 [not seen]. 1818

[**Ottsen, Hendrik**]. Journael van de Reis naar Zuid-Amerika (1598-1601), door HENDRIK OTTSEN, met inleiding en bijlagen, uitgegeven door J. W. IJZERMAN. LINDSCHOTEN-Vereeniging, 16), cxlv + 255 bdz., 3 kaarten en 5 platen. 's Gravenhage, M. NIJHOFF, 1918. 1818

Annotated reprint with elaborate introduction of the *Journael* first published in Amsterdam, 1603. G. S.

Spampanato, V. Vita di GIORDANO BRUNO con documenti editi e inediti. 2 vol. Messina, PRINCIPATO, 1921. 1818

Viviani, Ugo. ANDREA CESALPINO Le perizie medico-legali. L'epistolario. L'iconografia. La vita e le opere. Con prefazione di PAOLO ORANO, xii + 238 p., 26 pl., 34 ill. Castiglion Fiorentino, Tip. BENNATI, 1917 (1918). 1818

I quote this publication, which seems important, from MIEHL's review in his *Archiv*, t. I, p. 87-90, for I have been unable to obtain it though I have tried hard! G. S.

Vivier, P. MONTAIGNE, auteur scientifique, 41 p., Paris, MAURICE MENDEL, 1920? 1818

La philosophie des sciences dans MONTAIGNE. Physique du globe. Physiologie. Voyage en Italie. Influence et répercussion du tempérament de MONTAIGNE sur ses idées. Où le magistrat se confond avec le savant. G. S.

Wagner, Hermann. Die loxodromische Kurve bei G. MERCATOR. Ein Abwehr gegenüber Senhor JOAQUIM BENSAUDE (1917), *Nachrichten. Kgl. Ges. d. Wiss., philol. Kl., Göttingen*, p. 254-267, 1917. 1818

MERCATOR's globe of 1541 was the first correct application of the loxodromic lines to cartography. It is true that PEDRO NUNES was the first to have a clear idea of these curves and to show that they are spiral coilings round but never reaching the poles. Yet in 1537 NUNES was not yet able to trace correctly a loxodrome on a map, and there is no Portuguese map with correct loxodromes, anterior to MERCATOR's globe. (*Isis* III, 424), G. S.

S XVII.

Baumann, E. D. FREDERICK DEKKERS. *Janus*, t. 24, p. 233-252, 1919. 1818

Born The Hague, 1644, died Leiden, 1720. A distinguished Dutch clinician, the first to detect albumen in urine (1694) by boiling in the presence of vinegar, a discovery wrongly ascribed to DOMENICO COTUGNO (not COTUGNO) for the latter did not make it until 1764. G. S.

Berthé de Besaucèle, Louis. Les Cartésiens d'Italie. Recherches sur l'influence de la philosophie de DESCARTES dans l'évolution de la pensée italienne aux xvii^e et xviii^e siècles. *Thèse*, Aix), xxiv + 378 p. Paris, PICARD, 1920. 1818

Les conclusions de cette étude sont : 1^o Qu'il existait en Italie à une

époque de décadence, telle que la fin du xvii^e et le début du xviii^e, un courant de sagesse et de raison, principe du mouvement qui devait aboutir au *Risorgimento*; 2^o Que la philosophie cartésienne exerça une influence bienfaisante au delà des Alpes. G. S.

Brunner, Conrad und Muralt, Wilhelm von. Aus den Briefen hervorragender Schweizer Ärzte des 17. Jahrhunderts. Herausgegeben durch die Stiftung von Schnyder von Wartensee, x + 378 p., 14 illustr. Basel, BENNO SCHWALBE, 1919, [24 fr.]. 1818

This book contains more than the title promises, for the authors have added to the letters such abundant commentary that it might be called a history of medicine in Switzerland during the xviiith cent. They have taken pains also in the first part (p. 1-69) to summarize the whole development of medicine in that century in order to put the Swiss contributions in their true perspective. — Part II deals with the medical school of Schaffhausen: JOHANN JAKOB WEPFER (1620-1695); JOHANN CONRAD BRUNNER (1653-1727); JOHANN CONRAD PEYER (1653-1712). — Part III is entitled Zurich as a center of scientific and medical culture in the xviiith cent.; the main figure being that of JOHANNES VON MURALT (1645-1733). — Part IV is devoted to the medical faculty of Basel: JOH. JAKOB HARDER (1656-1711); THEODOR ZWINGER II (1658-1724). — Many other Swiss and foreign scientists are named in the commentary and in the letters published *in extenso*. The book will interest more particularly the Swiss scientists, but every student of science in the xviiith cent. will need to refer to it. There is a good index and excellent portraits of the scientists whom I have named, except PEYER of whom the authors could not find any (?). Other plates represent PEYER's glands, BRUNNER's glands, etc. G. S.

Eloy, Pierre. FAGON. Archiâtre du Grand Roi, 88 p., 2 portraits. Paris, Vigot, 1918. 1818

Cette biographie de GUY CRESCENT FAGON (1638-1718), premier médecin de Louis XIV, est une contribution intéressante à l'étude des mœurs médicales. Elle nous montre les démêlés de FAGON avec la cour et de quelle manière il comprenait son rôle. Il y a deux beaux portraits, l'un de FAGON, l'autre de MARÉCHAL, premier chirurgien du roi. G. S.

Gerhardt, Karl Immanuel. LEIBNIZ and PASCAL. With critical notes and a summary by J. M. CHILD and translations of LEIBNIZ's MSS. alluded to by Dr. GERHARDT. *The Monist*, vol. 28, p. 530-566, October 1918. 1818

[Hamel, Hendrik, van Gorcum]. Verhaal van het vergaan van het jacht De Sperwer en van het wedervaren der schipbreukelingen op het eiland Quelpaert en het vasteland van Korea (1653-1666), met eene beschrijving van dat Rijk. Uitgegeven door B. HOETINK, LIII + 165 bdz., 1 kaart, 11 afb. (LINDSCHOTEN-Vereeniging, XVIII). 's Gravenhage, M. NIJHOFF, 1920. 1818

Harris, David Fraser. ANTHONY VAN LEEUWENHOEK. the first bacteriologist. *Scientific monthly*, t. 12, p. 150-160, 1921. 1818

Jaeger, F. M. Over JOHAN JOACHIM BECHER en zijne relaties met de Nederlanden, 80 p. (Overdruk uit het *Economisch-Historisch Jaarboek*, Deel V), 's Gravenhage, MARTINUS NIJHOFF, 1919. 1818

Jourdain, Philip E. B. GALILEO and NEWTON. *The Monist*, t. 28, p. 629-633, 1918. 1818

An attempt to consider NEWTON's debt to GALILEO both in mechanics and mathematics, more fully than the author had done before. G. S.

Jourdain, Philip E. B. The analytical treatment of NEWTON's problems. *The Monist*, t. 30, p. 19-36, 1920. Elliptic orbits and the growth of the third law with NEWTON. *Ibidem*, p. 183-198. NEWTON's theorems on the attraction of spheres. *Ibidem*, p. 199-202. 1818

Knott, Cargill Gilston (editor). NAPIER tercentenary memorial volume, XI + 441 p., 16 pl. Published for the Royal Society of Edinburgh by LONGMANS, GREEN and Co., London, 1915. 1818

Contributions by C. G. KNOTT, Lord MOULTON, P. HUME BROWN, GEORGE SMITH, J. W. L. GLAISHER, D. E. SMITH, F. CAJORI, G. A. GIBSON, SALIH MOURAD, J. E. A. STEGGALL, G. VACCA, D. M. Y. SOMERVILLE, R. A. SAMPSON, H. ANDOYER, J. BAUSCHINGER, M. D'OCAGNE, E. GIFFORD, J. R. MILNE, T. C. HUDSON, A. HUTCHINSON, WILLIAM SCHOOLING, A. K. ERLANG, W. F. SHEPPARD, ARTEMAS MARTIN, H. S. GAY, ALBERT QUIQUET, etc. G. S.

Monal, Emile. Les maîtres apothicaires de Nancy au XVIII^e siècle. (Thèse, Nancy). 237 p., 5 pl., Paris, BERGER-LEVRAULT, 1917. 1818

Not seen ; quoted from an extract published by the author in the *Bulletin des sciences pharmacologiques*, t. 24, p. 92, sq. G. S.

Rambaud, Pierre. Les derniers statuts de la faculté de médecine de Poitiers (1617), *Janus*, 24^e année, p. 146-191, p. 225-232, 1919. 1818

Redgrove, H. Stanley and Redgrove, I. M. L. JOSEPH GLANVILL and psychical research in the XVIIIth cent., 94 p. London, W. RIDER, c. 1921 [not seen]. 1818

[**Rogierius, Abraham**]. De open-deure tot het verborgen heyndendom. Uitgegeven door W. CALAND. (LINSCHOTEN-VERENIGING, X), XLIV + 223 p. 's Gravenhage, M. NIJHOFF, 1915. 1818

An annotated reprint of this work first published in Leyden 1651, of which A. C. BURNELL said in 1898, « it is still perhaps the most complete account of S Indian Hinduism, though by far the earliest ». A German translation appeared in Nürnberg 1663 and French ones in Amsterdam 1670, 1672. G. S.

Roux, marquis de. PASCAL en Poitou et les Poitevins dans les Provinciales (*Bulletin de la Société des antiquaires de l'Ouest*, 1919), 51 p., 2 portraits. Paris, CHAMPION, 1919. 1818

Solovine, M. A propos d'un tricentenaire oublié : EDMÉ MARIOTTE (1620-1920). *Revue scientifique*, p. 708 et 709. Paris, 24 déc. 1921. 1818

Rappel des travaux de M. concernant la tache aveugle de l'œil humain, la compressibilité de l'air, la végétation des plantes, la nature des couleurs, le mouvement des fluides, etc. L. G.

Sorley, W. R. SPINOZA. *Proceedings of the British Academy*, 1917-1918, p. 469-486. 1818

Stefanini, Giuseppe. Uno speciale naturalista del secolo XVII (DIACINTO CESTONI). *Rassegna Nazionale*, 34 p. Firenze 1918. 1818

Biography followed by an account of CESTONI's (1637-1718) investigations on the locomotion of sea-urchins. G. S.

Stewart, H. F. La sainteté de PASCAL. Traduit de l'anglais par GEORGES ROTH. Avant-propos de EMILE BOUTROUX, xx+215 p. Paris, Bloud et Gay, 1919. 1818

Biographie. PASCAL polémiste. Son système doctrinal. Sa religion person-

nelle. Sept appendices dont le dernier considère les relations de PASCAL et de NICOLAS DE CUSE. G. S.

Tilden, William A. The resting-place of ROBERT BOYLE. *Nature*, vol. 108 p. 176, 1921. 1818

BOYLE died in London, Dec. 30, 1691 and was buried in the chancel of St. Martin's-in-the-Fields, but that church was pulled down in 1721. What became of BOYLE's remains then? TILDEN has not been able to solve the question. G. S.

Wieleitner, Heinrich. Zur Erfindung der Infinitesimalrechnung. MATHEMATISCHES Lesebuch, 5. Bd. 15 p. Sterkrade, W. OSTERKAMP, 1921. 1818

Clear summary of the question divided as follows : Integral calculus ; differential calculus ; NEWTON ; LEIBNIZ. G. S.

S. XVIII.

Bigourdan, G. L'observatoire de LE MONNIER dans la rue Saint-Honoré. *Comptes rendus de l'Académie des sciences*, t. 168, p. 642-647, 1919. — Les grands instruments et les travaux de LE MONNIER à cet observatoire. *Ibidem*, p. 709-713. — Ses travaux sur les étoiles et la physique du globe. — *Ibidem*, p. 745-749. — Ses travaux à la méridienne de Saint-Sulpice. La fin de l'observatoire de la rue Saint-Honoré. *Ibidem*, p. 808-812, 1025 (note). 1818

Bigourdan, G. L'observatoire de l'Hôtel de Cluny, plus tard Observatoire de la Marine. *Comptes rendus de l'Académie des sciences*, t. 168, p. 1025 1030, 1919. — Coordonnées et instruments de l'Observatoire de la Marine. *Ibidem*, p. 1137-1141. — Travaux de cet Observatoire. *Ibidem*, p. 1174-1178. 1818

[**Bouguer, Pierre**]. Essai d'optique sur la gradation de la lumière. Publié avec introduction par MAURICE SOLOVINE (Les Maîtres de la pensée scientifique, n° 11). Paris, GAUTHIER-VILLARS, 1921. 1818

PIERRE BOUGUER naquit au Croisic en 1698 ; il mourut en 1758. Son père était hydrographe et très connu par son *Traité de navigation*, 1699. L'*Essai d'Optique* parut en 1729 ; il est d'une grande importance historique, car c'est dans cet essai que furent posés les fondements de la photométrie. D'autres problèmes y sont étudiés. Par exemple BOUGUER s'efforce de déterminer la quantité de chaleur solaire absorbée par l'atmosphère et la quantité de lumière absorbée par les corps transparents ou diaphanes. BOUGUER inventa en 1748 un photomètre pour mesurer l'intensité du rayonnement solaire. Il découvrit que la lumière du soleil est plus intense au centre de son disque qu'à son bord et que le contraire s'observe sur le disque de la lune, etc. Un développement de cet essai, le *Traité d'optique sur la gradation de la lumière*, fut publié après sa mort par l'abbé DE LA CAILLE, en 1760. G.

[**Carnot, Lazare**]. Réflexions sur la métaphysique du calcul infinitésimal. (Les Maîtres de la pensée scientifique), 2 vol., VIII+117 +105 p. Paris, GAUTHIER-VILLARS, 1921. 1818

Ces *Réflexions* furent publiées en 1797 ; mais le texte ici reproduit est celui de la 2^e éd. de 1813. Il est remarquable que CARNOT (1753-1823) ait pu les écrire au moment où il était absorbé par mille soucis politiques et administratifs. Il vaut la peine de reproduire sa préface qui est d'une brièveté magistrale : « Je cherche à savoir en quoi consiste le véritable esprit de l'analyse infinitésimale ; les réflexions que je propose à ce sujet

sont distribuées en trois chapitres : dans le premier j'expose les principes généraux de cette analyse; dans le second j'examine comment elle a été réduite en algorithme par l'invention des calculs différentiel et intégral; dans le troisième je la compare aux autres méthodes qui peuvent la suppléer, telles que la méthode d'exhaustion, celle des indivisibles, celle des indéterminées, etc. ». Cet ouvrage eut beaucoup de succès; il fut traduit en allemand dès 1801 et en italien dès 1803. G. S.

- [**Cavendish, Henry**]. The scientific papers of the Honourable HENRY CAVENDISH, F. R. S. Vol. I. The electrical researches Edited from the published papers and the CAVENDISH MSS. in the possession of the Duke of Devonshire by J. CLERK MAXWELL. Revised by Sir JOSEPH LARMOR. Vol II. Chemical and dynamical. Edited from... by Sir EDWARD THORPE with contributions by CHARLES CREE and others. xxviii+452 p.; xii+496 p., 6 pl. Cambridge. University Press, 1921. [6 £]. 1815

Chaplin, Arnold. (1864-). Medicine in England during the reign of GEORGE III (The FITZPATRICK lectures delivered at the Royal College of Physicians, 1917-1918). London, II. KIMPTON, 1919. 1818

- [**Clairaut, Alexis-Claude**]. Eléments de géométrie (Les Maîtres de la pensée scientifique), 2 vol., xiv+95+103 p. Paris, GAUTHIER-VILLARS, 1920. 1815

Ces *Eléments de Géométrie* furent publiés par CLAIRAUT (1713-1765) en 1741, peu après son retour de Laponie. Il les avait rédigés à la requête de la marquise DU CHÂTELET qui voulait apprendre la géométrie. C'est un bel exemple de vulgarisation scientifique. La méthode suivie par CLAIRAUT c'est la méthode naturelle du concret à l'abstrait. Cependant son but n'est pas un but pratique comme celui des traités d'arpentage), mais théorique; il veut aider le lecteur « à découvrir les principales vérités géométriques ». Pourquoi les éditeurs font-ils de cet ouvrage deux volumes? Cela me paraît bien puéril. G. S.

- [**D'Alembert, Jean**]. Traité de dynamique (Les Maîtres de la pensée scientifique), 2 vol. Paris, GAUTHIER-VILLARS, 1921. 1818

La première édition du *Traité de dynamique* parut en 1743 (186 p. in-4°). D'ALEMBERT y énonçait le principe qui porte son nom. L'édition ici reproduite est la deuxième, publiée en 1758, soigneusement revue et considérablement augmentée (272 p. du même format). La réimpression de cet ouvrage fondamental est tout à fait opportune, car il y a toujours du profit à relire cette œuvre immortelle. Bezout avait contribué par 61 notes à cette édition; celles-ci sont également reproduites. G. S.

- Delaunay, Paul**. Médecins manceaux d'autrefois, 99 p. (*Bulletin de la Commission historique et archéologique de la Mayenne*). Laval, GOUPILO, 1920. 1818

Cette reconstitution de la vie médicale au Mans est basée sur des documents d'archives de Montpellier, Nancy, Reims, etc.; les documents cités sont presque tous du xviii^e siècle. L'ordre suivi est le suivant : La vie scolaire; la vie corporative; la vie familiale; la vie politique; la vie sociale. L'ouvrage se termine par des notes biographiques et généalogiques sur les médecins cités. G. S.

- Diderot**. Entretien entre d'ALEMBERT et DIDEROT. Rêve de d'ALEMBERT. Suite de l'entretien. Introduction et notes de GILBERT MAHIE, avec un portrait gravé sur bois par ACHILLE OUVRE. 197 p. (195 p. 135). Paris, éditions BOSSARD, 1921. 1818

Réimpression, sous une forme très soignée, dans la collection des chefs-

d'œuvre méconnus, de ces trois pièces qui permettent, mieux que toute autre, de définir ce qu'était le matérialisme de DIDEROT. Le texte reproduit est celui de l'édition ASSEZAT (1875), lui-même conforme à celui des *Mémoires et Correspondances*, publié en 1830. L. G.

Geikie, Sir Archibald. A memoir of JOHN MICHELL, fellow of Queen's College, Cambridge Woodwardian professor of geology in the University 1749-1762, 110 p. Cambridge University Press, 1918. 1818

Klinkowstroem, Carl von. GOETHE und RITTER. *Jahrbuch der Goethe-Gesellschaft*, Bd. 8, p. 135-151. Weimar, 1921. 1818

On the relations between GOETHE and the physicist Joh. WILH. RITTER (1776-1810) introducing 5 letters from RITTER to GOETHE, 1800-1804. The author mentions incidentally that a new edition of RITTER's *Fragmente aus dem Nachlass eines jungen Physikers* (2 vol., Heidelberg 1810), has been prepared by him, but that he does not know when it will be possible to publish it. G. S.

La Mettrie, Julien Offraye de. L'Homme machine, suivi de l'Art de jouir. Introduction et notes de MAURICE SOLOVINE, avec un portrait gravé sur bois par ACHILLE OUVRÉ, 219 p. (195×135). Paris, Editions BOSSARD, 1921. 1818

Réimpression, dans la Collection des chefs-d'œuvre méconnus, sous une forme extrêmement soignée, de l'*Homme-machine*, d'après l'édition originale de 1748, publiée à Leyde, et de l'*Art de jouir* d'après l'édition des Œuvres philosophiques (Amsterdam, 1753). Excellente introduction biographique et critique (p. 11-41); notes biographiques sur les auteurs cités par LA METTRIE (p. 203-216). (*Isis* 1, p. 274). L. G.

Leersum, E. C. van. Two of BOERHAAVE's lecture lists. *Janus*, 24 année, p. 115-124, 2 pl., 1919. 1818

[**Mather, Increase**]. Several reasons proving that inoculating or transplanting the Small Pox, is a lawful practice and that it has been blessed by God for the saving of many a life by INCREASE MATHER. Sentiments on the small pox inoculated by COTTON MATHER. Reprinted from the original folio single sheet printed at Boston in 1721. With an introduction by GEORGE LYMAN KITTREDGE, II + 86 p. Cleveland. Printed for private distribution, 1921. [95 copies]. 1818

This most interesting folio sheet has been elegantly reprinted at the expense of WILLIAM GWINN MATHER, Esq. of Cleveland, Ohio, a descendant of INCREASE MATHER, with a learned and delightful introduction by Prof. KITTREDGE of Harvard. Of the original only 3 copies are known to exist. The epidemic of small pox in Massachusetts (particularly in Boston) in 1721-1722 marks a date in the history of medicine because of the employment on a large scale of variolous inoculation. The credit belongs chiefly to COTTON MATHER and to ZABDIEL BOYLSTON who had the courage to practise inoculation in the face of every sort of opposition. By Sept. 7 he had inoculated 35 persons, with no deaths. It is interesting to note that the opposition was led by the medical profession, though one should add that there was at that time in Boston only one practitioner who could boast a medical degree. On the other hand MATHER has long been considered as an example of extreme superstition. INCREASE MATHER (COTTON's father), then in his 83rd year, and other ministers stood up to defend BOYLSTON against the physicians. To show the violence of the opposition which they had to overcome, it will suffice to say that some compared the belief in inoculation to witchcraft,

while others maintained that it would produce the plague! In this case, at least, the ministers were right against those who were supposed to represent science, the medical empiricists. G. S.

Mukandī Lal. Some notes on MOLA RAM. *Rupam*, no. 8, p. 22-30. Oct. 1921. 1918

A rather detailed account of the Rajput painter and poet of Garhwal, b. 1760 - d. 1833. A. K. C.

Seillièvre, Ernest. JEAN-JACQUES ROUSSEAU (Bibliothèque d'histoire littéraire et de critique), III + 458 p. Paris 1921. 1918

" C'est ici une biographie psychologique avant tout. Puisse-t-elle, sans distinction de partis, aider les hommes de bonne volonté sociale à voir plus clair dans le spectacle du présent pour influer de plus utile façon sur les possibilités de l'avenir, substituer un socialisme rationnel au socialisme romantique qui nous égare et mettre à la base des institutions de demain cette morale d'expérience qui s'appuie sur une psychologie clairvoyante et prescrit à chacun de subordonner raisonnablement sa puissance. " G. S.

[**Volta, Alessandro**]. Le opere di ALESSANDRO VOLTA. Edizione nazionale sotto gli auspici della Reale Accademia dei Lincei e del Reale Istituto Lombardo di Scienze e Lettere. Volume Primo, XXVIII + 591 p., 8 pl. Milano, Hoepli, 1918. 1918

This first volume edited by ADOLFO SOZZANI and LUIGI VOLTA contains the memoirs and letters written between 1792 and 1800. G. S.

Wallis, C. Edward. MARAT *Janus*, 24^e année, p. 77-81, 1919. 1918

S. XIX.

A. — Mathematics.

Amodeo, Federico, FORTUNATO PADULA e la ulteriore produzione di FLAUTI. *Atti dell'Accademia Pontaniana*, vol. 51, 30 p. Napoli 1921. 1918

F. PADULA (b. Naples 1816 — d. Naples 1881), mathematician, mechanician. VINCENZO FLAUTI d. in Naples 1863. G. S.

B. — Physical sciences and technology.

Abbot, C. G. The discovery of helium and what came of it. *Report of the Smithsonian Institution* for 1918, 121-126. 1918

Popular account including the latest application to ballooning. G. S.

[**Ampère**]. Centenaire de ses découvertes. 1918

On sait que les principaux travaux d'AMPÈRE dérivent de la généralisation qu'il donna de la découverte faite par ØRSTED en 1820 de l'action des courants sur les aimants. L'Académie des sciences et les principaux groupements électriques français, scientifiques ou industriels, ont décidé de profiter de la réunion à Paris, pendant la deuxième quinzaine de novembre 1921, de la Conférence internationale des grands réseaux à haute tension, pour commémorer à ce moment le centenaire des découvertes d'AMPÈRE. Un comité s'est institué ayant comme président M. DANIEL BERTHOLOT, comme secrétaire M. BLONDIS; il organise une manifestation qui aura lieu au Conservatoire national des arts et métiers, une séance solennelle en Sorbonne, sous la présidence de M. MILLERAND; une médaille commémorative sera frappée à cette occasion. L. G.

Ariès, E. L'œuvre scientifique de SADI CARNOT. Introduction à l'étude de la Thermodynamique, 160 p. Paris, PAYOT et Cie, 1921. ISIS

Le premier chapitre de cette étude constitue une histoire du principe de la conservation de l'énergie, dans laquelle l'auteur, se servant de certaines notes du mémoire de 1824 sur la puissance motrice du feu, et de papiers manuscrits de CARNOT restés ignorés jusqu'en 1878, montre, après L. DÉCOMBE (*C. R. de l'Acad. des Sciences*, t. 168, p. 268, 1919), que personne n'a de titres comparables à ceux de SADI CARNOT dans la découverte du premier principe, qu'il a formellement énoncé, et dont la paternité est généralement attribuée à MATER (1842) ou à JOULE. L. G.

Bell, Alexander Graham. Prehistoric telephone days. *National geographic magazine*, t. 41, p. 223-241, illustr. Washington, March 1922. ISIS

Autobiographical fragments of considerable interest, with excellent illustrations. G. S.

Delacre M. WURTZ et CLAUDE BERNARD. L'hypothèse et l'expérience dans les sciences. *Mercur de France*, p. 39-58. Paris 15 févr. 1922. ISIS

DELACRE reprend, contre le rôle de l'hypothèse, et à propos de deux livres récents : LESPIEAU, *La Molécule chimique* (*Isis*, III, 426-428) ; URBAIN, *Les Disciplines d'une science, la chimie*. (*Isis*, IV, p. 545), la charge à fond qu'il avait antérieurement développée dans son *Histoire de la chimie* (*Isis*, IV, p. 84). L. G.

[**Gerhardt, Charles.**] Centenaire de CHARLES GERHARDT (1815-1856) et de ADOLPHE WURTZ (1817-1884). ISIS

L'université de Strasbourg a fêté le 5 juillet 1921, n'ayant pas pu le faire pendant la guerre, le centenaire d'un de ses plus illustres élèves, AD. WURTZ, et d'un de ses plus illustres professeurs, CH. GERHARDT, de deux des plus grands animateurs de la chimie. Pour GERHARDT, inauguration d'une fondation universitaire qui porte son nom ; pour WURTZ, inauguration d'une statue sur la place où prenait jour la maison dans laquelle il est né. Les discours prononcés à cette occasion ont été publiés, avec une note introductive de M. TIFFENEAU, dans la *Revue scientifique* du 22 octobre 1921, consacrée à ces deux savants. L. G.

[**Langley, Samuel Pierpont, 1834-1906.**] Controversy about LANGLEY'S flying machine, WRIGHT brothers vs. LANGLEY, the attack against the latter being led by GRIFFITH BREWER, *Nature*, t. 108, 297-298, 1921 ; t. 109, 97-98, 305-307, 1922. ISIS

Lawson, R. W. The part played by different countries in the development of the science of Radioactivity. *Scientia*, t. xxx, p. 257-270, 1 octobre 1921. Traduct. française : supplément, p. 39-50. ISIS

L'auteur rappelle en particulier le rôle considérable et généralement ignoré, joué par le célèbre géologue SUSS dans la cession faite à P. CURIE et à Mad. CURIE des résidus industriels desquels ils isolèrent le Radium. L. G.

Leffmann, Henry. SAMUEL PIERPONT LANGLEY [1834-1906]. Pioneer in practical aviation. *Journal of the Franklin Institute*, vol. 187, Jan. 1919. Reprinted in *Report of the Smithsonian Institution for 1918*, p. 157-167, 9 pl. ISIS

Ramsay, Sir William. A tablet with a portrait medallion of Sir WILLIAM RAMSAY, by CHARLES L. HARTWELL, will be placed in Westminster Abbey as part of the RAMSAY memorial. (*Science*, t. 54, 151, 1921). ISIS

Regnault, F. L'évolution du cinéma, *Revue scientifique*, p. 79-86, Paris, février 1922. 1813

Excellente étude historique dans laquelle l'auteur, ancien élève de MAREY, apporte des documents nouveaux et corrige plusieurs erreurs; MAREY est incontestablement, au double point de vue scientifique et industriel, le père du cinéma, et non point DIMÉNY, comme il fut plusieurs fois écrit après la mort de celui-ci en 1917. Il est impossible de savoir à qui revient la paternité de plusieurs des perfectionnements trouvés, les brevets ne signifiant rien à cet égard. L. G.

Smith, Arthur Whitmore. JOHN TYNDALL (1820-1893). *Scientific monthly*, vol. 11, 331-340, 1920. 1818

C. — *Natural sciences.*

Corson, Eugene R. AGASSIZ's essay on classification fifty years after. *Scientific monthly*, vol. 11, p. 43-52, 1920. 1818

Apropos of LOUIS AGASSIZ. An *Essay on Classification*, London 1859 (first published as an introduction to his *Contributions to the Natural History of the United States*, 3 vol. 4°), by one who « cannot help feeling that AGASSIZ's heroic stand (against the theory of evolution) has been justified by the years which have passed by ». G. S.

Descour, L. PASTEUR et son œuvre, 296 p. (200 × 130). Paris, DELA-GRAVE, 1921. 1818

A toutes les études parues sur PASTEUR, L. DESCOUR vient ajouter un volume nouveau dans lequel on chercherait en vain quoi que ce soit qui n'ait été déjà dit. Il peut sembler, il est vrai, difficile d'ajouter quelque chose à la *Vie de PASTEUR* de VALLERY-RADOT, et aux travaux de ses collaborateurs DUCLAUX (LOUIS PASTEUR) et ROUX (*L'œuvre médicale de PASTEUR*), pour ne citer que ceux auxquels il est nécessaire de se reporter, et dont DESCOUR cite à maintes reprises de longs passages.

Il y aurait cependant peut-être lieu de ne pas réduire à un paragraphe de trois pages le compte rendu de la discussion engagée en 1876 entre PASTEUR et CH. BASTIAN au sujet de l'origine *de novo* de la matière vivante, discussion qui devait donner lieu à la nomination d'une commission de l'Académie des sciences chargée de départager les adversaires, qui n'assista jamais à une expérience de BASTIAN, et ne départagea donc rien du tout en réalité. L'admiration qu'à tout homme pour le génie de PASTEUR n'en serait en rien diminuée, pas plus qu'elle ne l'a été par les dernières publications du savant anglais sur le même sujet (1912).

Bonne reproduction du portrait de PASTEUR dans son laboratoire, dû à EDUARD LIT. Pas de bibliographie. L. G.

Dutrochet, René. Les mouvements des végétaux. Du réveil et du sommeil des plantes. Les maîtres de la pensée scientifique.) VIII-121 p. Paris, GAUTHIER-VILLARS, 1921. 1813

RENÉ DUTROCHET naquit au château de Néon (Indre) en 1776, il mourut à Paris en 1847. Il fut ruiné par la révolution, devint docteur en médecine en 1806. Les deux mémoires ici reproduits sont extraits de son livre : *Mémoires pour servir à l'histoire anatomique et physiologique des végétaux et des animaux*, 1837. DUTROCHET s'y révèle un adversaire irréductible du vitalisme. Il s'était donné pour tâche d'expliquer toutes les fonctions végétales et animales par des forces physiques. C'est surtout la physiologie botanique qui l'a intéressé et il y a fait des découvertes fondamentales. Par exemple, il est le premier à avoir tenté d'expliquer les mouvements de

la sève à l'intérieur des plantes par la diosmose et à avoir étudié parallèlement l'absorption de l'oxygène par les plantes et par les animaux. Il a mis en évidence l'action mécanique de l'endosmose et expliqué en première approximation les mouvements de la sève ascendante et descendante.

G. S.

Fabre, Jean-Henri.

1818

The French Chamber has voted a sum of 50,000 francs for the purchase of the small house and garden at Sérignan, where for many years JEAN-HENRI FABRE prosecuted his study of the habits of insects. FABRE died in the autumn of 1915 at the age of ninety-two. He had been a teacher at Ajaccio and Avignon before he retired, first to a little desert corner near Orange, on the Lower Rhône, and then to Sérignan, in the Department of Vaucluse. As an observer of insects he has been placed second only to RÉAUMUR. He was made a Chevalier of the Legion of Honour and a corresponding member of the Institute, and his house has been a place of pilgrimage for many admirers of his writings. His heirs have consented to the house becoming national property, and his eldest daughter will fulfil the duty of guardian. (*Nature*, t. 108, p. 543, 1921).

Hering, Ewald. Fünf Reden. Herausgegeben von H. E. HERING mit einem Bildnis, 140 p. Leipzig, ENGELMANN. 1920.

1818

The five lectures here reproduced by the care of his son are: Memory as a general function of organic matter (1870); Specific energies of the nervous system (1884); Theory of processes in the living substance (1888); Theory of nervous activity (1889) and finally the speech made by him when the ALBRECHT VON GRAEFE's medal was bestowed upon him by the Ophthalmologische Gesellschaft in Heidelberg 1906. HERING expressed his indebtedness on the one hand to LAMARCK and DARWIN, on the other to SCHOPENHAUER and FECHNER. The idea underlying his optical work was the following: "der gesamte sensorische und motorische Apparat des Sehorganes — dies Wort im weitestem Sinne genommen — ist ein Gebilde auf dessen Auf- und Ausbau eine unabsehbar lange Kette bewusster Wesen in Laufe unabsehbarer Zeiten gearbeitet hat". EWALD HERING was born in 1834; he died in 1918.

G. S.

Metchnikoff, Olga. Life of ELIE METCHNIKOFF, 1845-1916, xxii+297 p. London, CONSTABLE, c. 1921.

1818

Translation from the French of the book reviewed by L. GUINET, *Isis*, IV, p. 519.

G. S.

Orton, James. Memorial to JAMES ORTON, *Science*, t. 54, p. 216-217, 1921.

1818

JAMES ORTON was born at Seneca Falls, New York, 1830. He took part in three scientific expeditions to South America, and died in the course of the latter, in 1876, while crossing Lake Titicaca. His grave is on Esteves Island in that lake. The governments of Bolivia and Peru have erected a monument to him.

G. S.

Pasteur.

1818

JOHN D. ROCKEFELLER has provided funds for the purchase of the birthplace of PASTEUR at Dôle in the Jura. It will be transformed into a museum in which will probably be housed an extensive medical and surgical library, with the authentic documents of PASTEUR. (*Science*, t. 54, p. 574, 1921).

Penck, Albrecht. Die erdkundlichen Wissenschaften an der Universität Berlin. Rede zur Gedächtnisfeier des Stifters der Berliner

Universität König FRIEDRICH WILHELMS III in der Aula am
3. August 1918, 44 p. Berlin 1918. 1918

Wollaston, A. F. R. Life of ALFRED NEWTON, professor of comparative anatomy, Cambridge University, 1866-1907. With a preface by Sir ARCHIBALD GEIKIE, xv+332 p. London, Murray, 1921 (not seen). 1918

D. — *Medical sciences.*

Clark, Paul F. JOSEPH LISTER, his life and work. *Scientific monthly*, t. 11, p. 518-539, 1920. 1918

[**Donders, Franz Cornelis**].

A statue of DONDERS, the great Dutch ophthalmologist and physiologist, was recently unveiled at Utrecht where he had been professor of ophthalmology and of physiology until his death in 1889. (*Science*, t. 54, p. 151, 1921). 1918

McVail, John C. Half a century of small-pox and vaccination being the MILROY Lectures delivered before the Royal College of Physicians of London in March 1919, viii+87 p. Edinburgh, Livingstone, 1919. 1918

This survey by one who has been a student of the subject since 1882 will interest the historian, though its aim is medical rather than purely historical. Of the three lectures the first is devoted to Small-pox as it was and is; the second to Vaccination as it was and is; the third to Control of small-pox in the present day. The first is a clear summary of the history of small-pox in modern times, many statistics being quoted. The second lecture is largely « a rebutment of a contention that infantile vaccination, whilst protecting the individual, makes small-pox so mild and so difficult to recognize where it is not entirely prevented, that the result is such spread of infection from missed cases as to render the practice, on balance, disadvantageous to the community ». G. S.

Neuburger, Max. Die Wiener medizinische Schule im Vormärz, viii + 312 p. Wien, Rikola Verlag, 1921.

The medical school of Vienna has known two golden periods: the first founded by VAN SWIETEN lasted from the middle of the xviiith cent. to the Congress of Vienna, 1814 and is generally called the « Old Vienna School »; the second, due to the activities of ROKITSKY, SKODA and others reached its climax after the Revolution of 1848 during the third quarter of the century, and is called the « New Vienna School ». But what about the intervening period? Was medical life of no account in Vienna from c. 1814 to c. 1848? Of course not. NEUBURGER gives us a very live picture of these times by the simple expedient of quoting contemporary impressions (This is a sequel to his similar work on the Old School analyzed above by E. C. STRUBER, and the same general criticisms apply equally well to both books). There are also many accounts of the « Versammlung deutscher Naturforscher und Aerzte » which took place in Vienna 1832. Six portraits: LUCAS JOH. BOER, VINCENT V. KERN, CARL ROKITSKY, JOSEPH SKODA, FERD. HEBRA, SEMMELWEIS. G. S.

Pekelharling, A. C. FRANCISCUS CORNELIS DONDERS. *Janus*, 24^e année, p. 57-76, Leyde, 1919. 1918

Centennial celebration of the birth of the great Dutch ophthalmologist (1818-1889). G. S.

Ravenel, Mazijck P. (editor). A half century of public health. Jubilee historical volume of the American Public Health Association. xi + 461 p., New York, American Public Health Association, 1921.

1818

This beautiful volume, decorated with a portrait of Dr. STEPHEN SMITH, their founder and first president, and dedicated to him, contains the following contributions: the history of public health, 1871-1921 by STEPHEN SMITH; The American Public Health Association, past, present, future by MAZIJCK P. RAVENEL; The story of public health in Canada by PETER H. BRYCE; The history of bacteriology and its contribution to public health work by FREDERICK P. GORHAM; American mortality progress during the last half century by FREDERICK L. HOFFMAN; The United States quarantine system during the past fifty years by HUGH S. CUMMING; History of state and municipal control of disease by CHARLES V. CHAPIN; Fifty years of water purification by GEORGE C. WHIPPLE; Sewage and solid refuse removal by RUDOLPH HERING; Stream pollution by industrial wastes and its control by EARLE B. PHELPS; Progress in Federal food control by CARL L. ALSBERG; Food conservation by SAMUEL C. FRESCOTT; Milk and its relation to public health by CHARLES E. NORTH; The history of child welfare work in the United States by PHILIP VAN INGEN; Housing as a factor in health progress in the past fifty years by LAWRENCE VEILLER; What fifty years have done for ventilation by GEORGE T. PALMER; History of industrial hygiene and its effect on public health by GEORGE MARTIN KOBER; A fifty year sketch history of medical entomology and its relation to public health by L. O. HOWARD; The history of public health nursing by LAVINIA L. DICK.

G. S.

Schmiz, Karl (Privatdozent für Geschichte der Medizin). Die medizinische Fakultät der Universität Bonn, 1818-1918. Gedruckt mit Unterstützung der Fakultät, viii + 103 p. Bonn, MARCUS und WEBER, 1920.

1818

This study had been prepared for the second volume of the Festschrift celebrating the centenary of Bonn University, but the publication of this second volume could not take place. Dr. SCHMIZ' contribution is thus published independently. The story, which I will not attempt to summarize, is divided as follows: General development, manners and currents (this is the most interesting part for the historian who is not specially familiar with Bonn); institutes of the medical faculty; medical teaching in Bonn (generalities, then by subjects). An appendix gives one the list of deans and instructors, and statistics: the number of medical students was 156 in 1825, 325 in 1895, 207 in 1905, 1026 in 1915.

G. S.

Weber, Sir Hermann. Autobiographical reminiscences written privately for the family, with annotations and a list of his medical writings by his son FREDERICK PARKES WEBER, 121 p., 21 illustr. London, JOHN BALE, SONS and DANIELSSON, 1919.

1818

HERMANN WEBER, born 1823 in Holzkirchen, Lower Franconia, Bavaria, died in London 1918. Eminent physician; one of the pioneers of the open air treatment of consumption; enthusiastic member of the Alpine club; collector of Greek coins; author of books on climatotherapy, balneotherapy, hygiene, consumption. This autobiography was written when he was already 90 years of age, partly in English, partly in German. It is followed by various obituary notices, bibliographical lists and a splendid set of portraits.

G. S.

E. — *Alia*.

Babinger, Franz. ISAAC JAKOB SCHMIDT. (1779-1847). Ein Beitrag zur Geschichte der Tibetforschung. *Ostasiatische Z.*, t. 8 p. 7-21, 1920.

1818

Bernard, L. L. HERBERT SPENCER'S work in the light of his own life. *The Monist*, t. 31, p. 1-35, 1921.

1818

Bezold, Friedrich von. Geschichte der Rheinischen Friedrich Wilhelms-Universität von der Gründung bis zum Jahr 1870, x + 535 p. Bonn, MARCUS und WEBER, 1920.

1818

History of Bonn University from 1814 or 1818 to 1870; enormous as it is, it is only a part of the Festschrift originally prepared for the centenary which would have been celebrated in 1918 but for the war. This volume deals with the University as a whole; a second volume dealing with the special history of every department was planned but will not be published.

G. S.

Bonney, Thomas George (1833-). Annals of the Philosophical Club of the Royal Society written from its minute books, x + 286 p. London, MACMILLAN, 1919.

1818

Faulds, Henry. The hidden hand. *Vestigia nulla retrorsum*. With appendix, 16 p. The Author, Regent House, Hanley, Stoke-on-Trent, England [no date].

1818

Dr. HENRY FAULDS must be considered the inventor of the finger-prints system of identification, if one admits that such a system is not complete and of no use for police purposes, if it does not include a simple method of indexing the prints. Dr. FAULDS' first communication of the subject appeared in *Nature*, Oct. 28, 1880. Sir WILLIAM J. HERSCHEL had made use of finger-prints in India, before, even as early as 1858, but before 1880 he had published nothing on the subject, he had not thought out a method of indexing and had not tested in a scientific way the fundamental question of permanency.

G. S.

Gossart, Ernest. ADOLPHE QUETELET et le prince ALBERT de Saxe-Cobourg (1836-1861). *Bull. de la Classe des lettres de l'Acad. de Belgique*, p. 211-254, 1919.

1818

L'appendice (230-254) contient des extraits de la correspondance de QUETELET.

G. S.

Mills, William Haslam. The Manchester Guardian. A century of history, 146 p. London, CHATTO and WINDUS, 1921.

1818

Thayer, Alexander Wheelock (1817-1897). The life of BEETHOVEN. Edited, revised and amended from the original English manuscript and the German editions of HERMANN DEITERS and HUGO RIEMANN, concluded and all the documents newly translated by HENRY EDWARD KREIBEL, 3 vol. New York, BEETHOVEN Association, 1921.

1818

The German edition appeared in 5 vol. from 1866 to 1908.

S. XX.

Millikan R. A. Twentieth century physics. *Proc. of the American Institute of Electrical Engineers*, Sept. 1917. Reprinted in the *Report of the Smithsonian Institution for 1918*, p. 169-184.

1818

Rasmussen, Knud. Greenland by the Polar sea. The story of the Thule Expedition from Melville Bay to Cape Morris Jesup. Translated from the Danish by ASTA and ROWLAND KENNEY, XXIV + 327 p. London 1921. ISIS

PART II.

Historical Classification.

Including only the materials which could not be included in Part I, the fundamental (centurial classification).

1 and 2. — ANTIQUITY.

Autran, Ch. Phéniciens. Essai de contribution à l'histoire antique de la Méditerranée, xv + 146 p. Paris, GEUTHNER, 1920. ISIS

The author's thesis is that the proto-Phenicians were not Semites but Caucasians, like the men to whom we owe the Egean civilization.

G. S.

Evans, Sir Arthur. The palace of Minos, at Knossos. A comparative account of the successive stages of the early Cretan civilization as illustrated by the discoveries. Vol. I. The Neolithic and Early Middle Minoan Ages, xxiv + 721 p., 11 pl. London, MACMILLAN, 1921. ISIS

Guignebert, Charles. Le christianisme antique. Paris, FLAMMARION, 1921. ISIS

Hammarström, Magnus. Beiträge zur Geschichte des etruskischen, lateinischen und griechischen Alphabets, VIII + 58 p. *Acta societatis scientiarum fennicae*, t. 49. Helsingfors, 1920. ISIS

Hazzidakis, Joseph. Tyllissos à l'époque minoenne. Suivi d'une note sur les larnax de Tyllissos (Etude de préhistoire crétoise). Traduit du grec par l'auteur avec la collaboration de L. FRANCHET. Introductions et annotations par L. FRANCHET, 91 p., 48 fig., 10 pl. Paris, GEUTHNER, 1921. ISIS

Les fouilles de Tyllissos n'ont pas fourni d'objets d'une grande valeur intrinsèque, mais elles sont extrêmement importantes au point de vue chronologique. Les conclusions de l'auteur, c'est que les neuf divisions chronologiques de EVANS ne sont pas applicables, au moins à Tyllissos, parce qu'elles ne sont pas suffisamment tranchées. Ce premier mémoire, publié d'abord dans l'*Ἀρχιολογική Ἐφημερίς*, est consacré à la description des objets trouvés de 1909 à 1912. Les études de L. FRANCHET sur la céramique antique (voir son Rapport sur une mission en Crète et en Egypte, 1912-1913. *Nouv. archives des missions scientifiques*, fasc. 15, Paris 1916) ont confirmé les conclusions de HAZZIDAKIS. Voici d'ailleurs la nouvelle chronologie crétoise proposée par FRANCHET :

Néolithique ancien ; puis le Néolithique récent.

Énéolithique correspond à M. P. I et II de EVANS.

Bronze I " M. P. III et M. M. I.

Bronze II " M. M. II, début de M. M. III

Bronze III " fin de M. M. III et M. D. I et II.

Bronze IV " M. D. III

1^{er} Age du Fer " Époque géométrique.

G. S.

Heitland, W. E. *Agricola. A study of agriculture and rustic life in the Greco-Roman world from the point of view of labour*, x + 492 p. Cambridge 1921.

An encyclopedia of the subject completed by elaborate indexes. The subject is dealt with from the Homeric age down to Byzantine times (only 5 pages being devoted to the latter, however: *Geoponica*; *The farmer's law* of c. 740). 1818

Laurand, L. *Manuel des études grecques et latines*, vii + 934 p. Paris, AUGUSTE PICARD, 1921. 1818

This Manual of classical studies is divided into 7 parts, each of which can be bought separately: the first three deal with Greek studies (Geography, history, institutions, literature, historical grammar); the following three with Roman studies (same order); the last one is common to both Greek and Roman studies, and deals with metre, textual criticism, establishment and interpretation of texts, paleography, epigraphy, numismatics, archeology, history of philology, bibliography, organization of philologic research. The scope of this Manual is obviously much narrower, and its size much smaller, than those of the two *Companions* published by the Cambridge University Press. However, even those who use regularly the latter will find it probably profitable to refer to the French Manual, which is the fruit of a long experience and of much learning and wisdom. G. S.

Merlin, A. *La civilisation carthaginoise. Journal des Savants*, p. 193-203, 1920. 1818

Apropos of STÉPHANE GSELL. *Histoire ancienne de l'Afrique du Nord*, IV. *La civilisation carthaginoise*, 515 p. Paris, HACHETTE, 1920. G. S.

Ninck, Martin. *Die Bedeutung des Wassers im Kult und Leben der Alten. Eine symbolgeschichtliche Untersuchung*, vii + 190 p. Leipzig, DIETERICH, 1921. 1818

Paton, Lewis Bayles. *Spiritism and the cult of the dead in antiquity*, 325 p. New York, MACMILLAN, 1921. 1818

During the last quarter of a century we have witnessed an immense revival of interest in the phenomena of spiritism. It has seemed timely therefore to present a study of similar psychical manifestations in antiquity. The author has enjoyed the assistance of many of his learned colleagues of the Hartford Seminary. His survey is very comprehensive: Spiritism in primitive religion; in China; among the Indo-Europeans; the cult of the dead among the latter; spiritism in Egypt; among the early Semites; in Babylonia and Assyria; earliest Hebrew conception of the dead; Babylonian influence on it; worship of the dead by Israel; early opposition to it; prophetic and legal denial of the vitality of spirits; new theories of immortality in post-exilic Judaism; teaching of Jesus in regard to immortality. G. S.

Rostovtzeff, M. *The foundations of social and economic life in Egypt in Hellenistic times. Journal of Hellenic studies*, t. 6, p. 161-178, 1920. 1818

Rostovtzeff, M. *L'exploration archéologique de la Russie méridionale de 1912 à 1917. Journal des Savants*, p. 49-61, 109-122, 1920. 1818

Schramm, E. *Μονάρχων und Onager. Nachrichten, Kgl. Ges. d. Wiss., Göttingen. phil. Kl.*, p. 259-271, 2 pl., 1918. 1818

The *μονάρχων* described in Apollonios' *Polioreetikes* and also in a

writing attributed to HERO OF BYZANTIUM and the onagre described by AMMIANUS MARCELLINUS are identical. G. S.

Schramm, Erwin. (*Generalleutnant z. D.*). Die antiken Geschütze der Saalburg. Bemerkungen zu ihrer Rekonstruktion. Neubearbeitung der Schrift « Griechisch-römische Geschütze » (1910) mit 11 Tafeln und 38 Textfig. Herausgegeben von der Saalburgverwaltung, 88 p. Berlin, WEIDMANN, 1918. 1818

The result of painstaking investigations carried on since 1903 by Dr. SCHRAMM and since 1904 by the late RUDOLF SCHNEIDER on the ballistic engines described by HERO, PHILO, VITRUVIUS, AMMIANUS, some of which were reconstructed either in natural or in a smaller size. The work is divided as follows: introduction containing the history and bibliography of the question; history of ancient ballista and other engines for throwing missiles; monuments reproducing such engines; description of the original engine discovered in 1912 in Ampurias, Spain (the *capitulum* of a Roman engine of the 11th cent. B. C.); finally an elaborate and very precise description and discussion of the reconstructed engines; HERO's gastraphetes and euthytonon; PHILO's palintonon, polybolon and aërotonon; VITRUVIUS' catapulta and ballista; AMMIANUS' scorpio or onager, etc. Working drawings are provided and the description is a technical one; the machines constructed for the author were actually used and tested. The late RUDOLF SCHNEIDER was responsible for the philological study; General SCHRAMM for the technical. Their work is fundamental. G. S.

Stéphanidès, M. La naissance de la chimie. *Scientia*, Bologna, p. 189-197, mars 1922. 1818

La naissance de la chimie coïncide avec celle de la chrysopée, ou fabrication de l'or, à l'époque de l'invasion de l'Égypte par les Ethiopiens (718 av. J.-C.); le travail de laboratoire de l'art sacré consistait à opérer sur les substances métalliques de façon à en faire le χρῶμα qui donnerait de l'or et dont l'élément fondamental était le plomb. C'est de cet art sacré, d'*origine métallurgique*, que les Grecs d'Alexandrie et de Byzance ont fait, avec le concours de la philosophie, la χυμεία, base de l'alchimie des Arabes et des Occidentaux. (*Isis*, III, 430-433). L. G.

Trüdinger, Karl. Studien zur Geschichte der griechisch-römischen Ethnographie, 175 p. (*Diss.*, Basel). Basel, BIRKHÄUSER, 1918. 1818

It will suffice to indicate the contents of this thesis: Ionian ethnography; new orientation in the 19th cent.; THEOPOMPUS; the historians of ALEXANDER; POSIDONIUS; SALLUST and POMPEIUS TROGUS; idealisation of peoples; TACITUS' *Germania*. The περί δέπων analyzed by F. JACOBY. One notices that TRÜDINGER has focused his study of ancient ethnographical ideas upon a few representative personalities. It is sad to think that the gifted author died soon after the publication of his work. G. S.

Viedebantt, Oskar. POSEIDONIOS, MARINOS, PTOLEMAIOS. Ein weiterer Beitrag zur Geschichte des Erdmessungsproblems im Altertum. *Klio*, t. 16, p. 94-108, 1919. 1818

Including an appendix on HERODOTUS' stadium. G. S.

Wesge, Fritz. Etruskische Malerei. Mit 89 Textabbild. und 101 Tafeln. 120 p., 4°. Halle (Saale), MAX NIEMEYER, 1921. 1818

An elaborate study not of all Etruscan paintings but of those of the great cemetery of Tarquinii, the old Etruscan capital, near Corneto. Excellent illustrations. G. S.

Whitaker, Joseph I. S. Motya, a Phoenician colony in Sicily, xvi + 357 p., 1 pl., 116 ill., 2 maps. London, BELL, 1921. 1818

Account of the systematic exploration of Motya or rather of its fringe. Motya is the modern islet of San Pantaleo, near Marsala on the Westernmost part of Sicily; this islet is entirely owned by the author. "On no other Phoenician site, perhaps, are so many ruins of an important fortified city still to be found standing *in situ* at the present day as at Motya." P. 260-354 give a description of the Motya Museum organized on the island by the author and GIUSEPPE LIPARI-CASCIO. G. S.

3. — ASIA.

Bloch, Stella. Dancing and the drama East and West. With an introduction by ANANDA COOMARASWAMY, 13 p., illustrated by the author, New York, Orientalia, 1922. 1818

"Nominally an essay on the theatre, this is something more than a discussion of Oriental dancing: it is an introduction to the theory of Asiatic civilization." (A. C.) Miss BLOCH's drawings of various Oriental dancers or actors are very good. G. S.

Eliot, Sir Charles. Hinduism and Buddhism. 3 vol. civ + 345 p., 322 p., 513 p. London, EDWARD ARNOLD, 1921. 1818

An encyclopedia of the subject with elaborate index by one who has lived in the Far East since 1912 and has travelled in all the countries he speaks of except Tibet. His object has been to trace the history and development of religion in India, Central and Eastern Asia, with occasional remarks on its latest phases but no systematic attempt to describe modern conditions. Introduction. Early Indian religion. Pali Buddhism. Mahayana. Hinduism. Buddhism outside India. Mutual influence of Eastern and Western religions. Elaborate index (50 p.). G. S.

Eastern Asia.

Coomaraswamy, Ananda K. Notes on the Javanese theatre. *Rupam* n° 7, p. 5-11, 11 ills. Calcutta 1921. 1818

Shadow plays and human actors; general considerations on Asiatic dramatic technique. The author is not responsible for the incorrect descriptions of the illustrations. A. K. C.

Döhring, K. Kunst und Kunstgewerbe in Siam. Lackerarbeit in schwarz und gold, 3 vol., 76 p. 62 ills. 50 pl. Berlin, BARD, 1914. 1818

A most luxurious production. Only five copies produced (of 500 intended). Prof. DÖHRING, Court Architect to H. M. the King of Siam, had projected a whole series of works on Siamese art, the publication of which has now become impossible. A. K. C.

Döhring, K. Buddhistische Tempel-Anlagen in Siam, 3 vol., 356 p., 180 pl. Berlin, Verlag Asian, 1916. 1818

Fruin-Mees, W. Geschiedenis van Java. Deel 1, Hindutijdperk, 110 p. 30 pl., map. Deel 2, 127 p., 22 pl., map. Weltevreden, Com. voor de Volkslectuur. 1919, 1920. 1818

Groslier, G. Recherches sur les Cambodgiens, d'après les textes et les monuments depuis les premiers siècles de notre ère, x + 432 p., 48 pl., 175 figs., Paris, CHALLAMEL, 1921. 1818

A detailed survey based on the monuments and monumental inscriptions.

chiefly of Banteai Chhma and the Angkor group. The history is divided into Primitive, before the Indian influence; Archaic, ending with the viith century A. D.; Classic, viith to xiiith century; Modern, or Neo-Angkorean: and Contemporary, or Siam-Khmer, including all subsequent to the Siamese conquests in the xvith century. The subjects dealt with at length, and fully documented by 200 reproductions of photographs, and 1153 drawings and plans, include Writing, Trade, Weights, Measures and Coins, Costume, Coiffure, Jewellery, Arms, Vehicles and Trappings, Musical Instruments, Pottery, Food; and the actual monuments, which are systematically reviewed from the point of view of the historian of art. Valuable comparisons of ancient and modern data are made: the sculptured costume, for example, has been experimentally studied on the living model. As G. GROSLIER remarks, "If, for example, similar work were done in Java, India, Siam, Burma, and China, a broad comparative survey of these countries would then be possible", and such a comparison would throw much light upon the racial history and migrations of the Far East. G. GROSLIER, already well known as the author of *Danseuses Cambodgiennes* (Paris, 1913), illustrated, like the present work, by his own drawings, is at present Directeur des Arts cambodgiens. A. K. C.

The principal interest of Cambodian art lies in the fact that it illustrates in a remarkable way the age-long conflict between Chinese and Hindu influences. The author attaches more importance to the former than has been done heretofore. To be sure, Chinese influences were more congenial to Cambodian mentality. G. S.

Jasper, J. E. en Pirngadie, Mas. De inlandsche Kunstnijverheid in Nederlandsch Indie. vol. 1. Het Vlechtwerk, 240 + XL p., 81 pl.; vol. 2. De Weefkunst, 375 p., 32 pl.; vol. 3. De Batikkunst, 279 p., 30 pl. 's Gravenhage, MOUTON, 1912-1916. 1S1S

A learned and richly illustrated, exhaustive treatise on the textile arts of Java and Sumatra, Bali, Sumbawa, etc. Numerous coloured plates.

A. K. C

Krause, Gregor. Einiges über die Hygiene bei den Baliërn. *Janus*, 24^e année, p. 101-114, 1919. 1S1S

McGovern, William Montgomery. An introduction to Mahāyāna Buddhism. With special reference to Chinese and Japanese phases, v + 233 p. London, KEGAN PAUL, 1921. 1S1S

[**Musée Guimet**] *Bulletin archéologique* Fascicule I. Salle EDOUARD CHAVANNES. Missions Ed. CHAVANNES (1907), VICTOR SEGALEN, GILBERT DE VOISINS et JEAN LARTIGUE (1915), VICTOR SEGALEN (1917). — Fascicule II. Asie Centrale et Tibet. Missions PELLIOI et BACOT. 2 vol. in 4^o, 72 et 38 p., Paris-Bruxelles, VAN OEST, 1921. 1S1S

A. MORET, conservateur du Musée GUIMET, a estimé que la fondation qu'il dirige pouvait, par une nouvelle initiative ajoutée à tant d'autres, accroître encore les services qu'elle rend à la science. Aucun moyen terme n'avait été conçu jusqu'ici entre l'exposé que fournit un livre et la documentation fragmentaire que donne un catalogue. Les magnifiques résultats des explorations entreprises par des Français depuis quinze ans risquaient donc de demeurer inaccessibles au grand public et méconnus des Orientalistes mêmes, une fois terminée l'exposition des trophées archéologiques conquis sur le passé. Désormais MORET et HACKIN, assistés d'un comité de rédaction composé de FINOT, DE GOLOUBEV, SYLVAIN LÉVI, MAITRE et PELLIOI, disposeront d'un Bulletin qui ne paraîtra que lorsque se sera produit quelque événement se rattachant à l'activité du Musée, mais qui présen-

tera en temps opportun l'appréciation synthétique des découvertes toutes fraîches et inédites. On augurera favorablement de cette nouvelle publication par la consultation des deux premiers fascicules, consacrés à rendre hommage à l'œuvre du maître si regretté de la sinologie, Ed. CHAVANNES, et à préciser la portée des missions SEGALEN en Chine, PELLIOI en Asie Centrale et BACOT au Tibet. J. HACKIN inventorie les richesses moissonnées en Sérinde, notamment à Touen-houang, et fait preuve d'une sûre maîtrise en signalant la contribution de ces découvertes à notre connaissance de l'iconographie bouddhique. P. M.-O.

[Syria]. A handbook of Syria (including Palestine. Prepared by the geographical section of the Naval intelligence division, Naval staff, Admiralty, 723 p., xiv pl. London, H. M.'s stationery office 1920. [10 sh.] 1818

An elaborate survey of Syria to as far north as the R. Orontes and a line Antioch-Aleppo-Meskeneh. The first 9 chapters (324 p.) deal with Syria as a whole: Boundaries and physical survey, climate, natural resources, history, inhabitants, Turkish administration, agriculture, industry and trade, currency, weights and measures. The remaining 12 chapters enter into much more detail and treat separately with every district. G. S.

4 — BABYLONIA and ASSYRIA.

Cruveilhier, P. Les principaux résultats des nouvelles fouilles de Suse, IX + 154 p. Paris, GEUTHNER. 1921. [7,50 fr.] 1818

Vulgarisation des découvertes décrites dans les tomes X à XV (1908 à 1914) des *Mémoires de la Délégation en Perse et mise au point de la question*. Cet ouvrage ne fait pas double emploi avec l'article du R. P. LAGRANGE dans le *Correspondant*, 1913, ni avec le *Catalogue des antiquités de la Susiane du Louvre* publié par MAURICE PÉZARD en 1913, car le but en est différent. L'auteur a voulu résumer l'état de nos connaissances sur l'histoire, la religion, le droit et la philologie. G. S.

Cuq, Edouard. Les nouveaux fragments du Code de HAMMOURABI sur le prêt à intérêt et les sociétés. *Mémoires de l'Académie des inscriptions*, t. 41, p. 159-270, Paris 1920. 1818

Ginzel, F. K. Die Wassermessungen der Babylonier und das Sexagesimalsystem. *Klio*, t. 16, p. 234-241, 1920. 1818

Jastrow, Morris and Albert T. Clay. An old Babylonian version of the Gilgamesh epic, on the basis of recently discovered texts, 106 p., 7 pl. New Haven, Yale University Press, 1920. 1818

Lutz, H. F. A contribution to the knowledge of Assyro-Babylonian medicine. *The American Journal of Semitic languages*, t. 36, p. 67-83, 1919. 1818

Schwenzner, Walter. Altbabylonische Marktpreise. (*Diss.*, Breslau.) Kirchhain, SCHMERSOW, 1915. 1818

Ungnad, A. Bemerkungen zur babylonischen Himmelskunde. *Z. d. deut. morgenl. Ges.*, t. 73, p. 159-175, 1919. 1818

Weissbach, F. H. Neue Beiträge zur keilinschriftlichen Gewichtskunde. *Z. d. deutschen morgenl. Ges.*, t. 70, p. 49-91, 354-402. Leipzig, 1916. — Bemerkungen by C. F. LEHMANN-HAUPT *Ibidem*, p. 521-524; t. 71, p. 269, 1917; t. 72, p. 287, 1918. 1818

5. — BIBLE.

(Old Testament civilization.)

Jeremias, Alfred. Das alte Testament im Lichte des alten Orients. Dritte völlig neubearbeitete Auflage, xvi+712 p., mit 306 Abb. und 2 Karten Leipzig, HINRICHS, 1916. 1818

Montgomery, James A. The opportunity for American archaeological research in Palestine. Report of the Smithsonian Institution for 1919, p. 433-441, 3 plates, Washington 1921. 1818

Vernes, Maurice. Le serpent d'airain fabriqué par Moïse et les serpents guérisseurs d'ESCUAPE. *Revue archéologique*, t. 7, p. 36-49. Paris, 1918. 1818

Vernes, Maurice. Utilisation religieuse des monuments mégalithiques par les anciens Hébreux. *Revue archéologique*, t. 7, p. 275-290. Paris, 1918. 1818

6. — BYZANTIUM.

Reitzenstein, R. Zur Geschichte der Alchemie und des Mysticismus. *Nachrichten, Kgl. Ges. d. Wiss., zu Göttingen*, phil. Kl., p. 1-37, 1919. 1818

Apropos of the dialogue of CLEOPATRA with the philosophers (*i. e.* the alchemists) already published and translated by BERTHELOT (*Collection des anciens alchimistes grecs*, Paris, 1888, 3^e livraison, p. 278-287; 289-299). New text based upon that contained in the Marcianus 299 (xith cent.), a great collection of alchemic writings, compiled c. 525, wherein it is entitled διάλογος φιλοσόφων καὶ Κλεοπάτρας (BERTHELOT's edition contains this text plus a part of the preceding one). At the end of this compilation had been added later other texts, in verse and prose, of which one piece is edited by REITZENSTEIN in an appendix entitled: a Neoplatonic Theophrastus Redivivus. It dates probably of the beginning of the viiith century. G. S.

7. — CHINA.

Bezold, C. SZĚ-MA TS' IEN und die babylonische Astrologie. *Ostasiatische Z.*, t. 8, p. 42-49, 1920. 1818

The Chinese had become acquainted with Babylonian astrology probably already before 523 B. C. and they adapted their own old Chinese names to the Babylonian constellations. Traces of this are found in the Shi-ki (?). G. S.

Bouillard, G. et le commandant **Vaudescal.** Les sépultures impériales des Ming (Che san ling). *Bulletin de l'Ecole française d'Extrême-Orient*, t. 20, n° 3, grand in-8 de 128 p. et 44 planches, Hanoï, 1920. 1818

La nécropole où reposent treize empereurs de la dynastie des Ming (1368-1644), près de Tch'ang-p'ing tcheou, à 40 kilomètres au N.-O. de Pékin, est étudiée ici avec la volonté de confronter la réalité actuelle et les descriptions anciennes. Ce travail n'apporte pas seulement une contribution importante à l'archéologie; il illustre par un exemple concret les croyances chinoises relatives au culte des souverains défunts et à la géomancie. Des portes sont érigées non pour ménager un accès vers une direction donnée, mais au contraire pour barrer la route à des effluves malfaisants. Le choix

des emplacements des sépultures met en œuvre des règles de *fong-chouei*, en vertu desquelles les tombes doivent être préservées des vents pernicieux, mais favorisées des souffles propices, tenues à l'écart des courants rigides ou contraints, mais participer à la proximité salulaire des eaux paisibles. Des avenues sans but apparent, des brisures de perspective se justifient par le désir d'éviter un obstacle à des esprits que l'on veut honorer, de détourner des influences malignes. Maintes singularités de l'esthétique chinoise trouvent de la sorte leur décisive explication, et une lumière très vive se trouve jetée sur une pseudo-science, cas fort curieux de positivisme mystique.

P. M.-O.

Doré, François J. La thérapeutique et l'hygiène en Chine. De l'influence des superstitions sur le développement des sciences médico pharmaceutiques. Préface du prof. EM. PERROT. VII+221 p. Paris, Vigor, 1920. [12 francs] 1918

Cette étude est basée en premier lieu sur les documents fournis à l'auteur par son frère, le R. P. DORÉ, S. J., dont les *Recherches sur les superstitions en Chine* (Cheng-Hai, impr. de T'ou-sé-wé, 12 vol.) sont bien connues et dont l'expérience chinoise est considérable. Par ex. le P. DORÉ a bien voulu traduire quelques-uns des livres de médecine en usage. Elle complètera donc les travaux des MATIGNON, LEGENDRE, REGNAULT, VINCENT, HURRIER, et d'autant plus que l'auteur ne s'est pas borné à étudier la médecine proprement dite; ses recherches ont porté surtout sur les pratiques superstitieuses tant bouddhistes que taoïstes. Son travail est divisé comme suit : Comment on devient médecin ou pharmacien. Principaux guérisseurs. La médecine. La pharmacie. Superstitions dans leurs rapports avec la médecine et l'hygiène. Les talismans et l'Olympe chinois. Le peuple. Hygiène et épidémies. Conclusion (condamnation formelle de la médecine chinoise). Un index, surtout des mots chinois, eût été fort utile.

G. S.

Forke, Alfred. Der Festungskrieg im alten China. *Ostasiatische Z.*, t. 8, p. 103-116, 1920. 1918

Groot, J. J. M., De. Universismus. Die Grundlage der Religion und Ethik, der Staatswesens und der Wissenschaften Chinas. VIII+404 p. Berlin, 1919. 1918

German translation of the author's *Religion in China, Universism. A key to the study of Taoism and Confucianism*, xv+327 p. New-York, 1912, with five new chapters and the original Chinese texts. Severely criticized by PELLIER in *Journal asiatique*, t. 16, p. 158-165, 1920. G. S.

Herrmann, Albert. Die ältesten chinesischen Karten von Zentral- und Westasien. *Ostasiatische Z.*, t. 8, p. 185-198, 1920. 1918

The two oldest maps here reconstructed and reproduced date respectively from 440 and 605-6. They will be published again by SVEN HEDIN in his "Southern Tibet. Discoveries in former times compared with my own researches in 1906-1908. Vol. VIII, Stockholm, 1920". G. S.

Launay, Adrien. Histoire des missions de Chine (Société des missions étrangères). Missions du Se-Tchoan, t. I, XXI+662 p. Paris. TÊQUI, 1920. 1918

Retraces the history of the Roman Catholic missions in "Ssüch'nan" from 1640 to 1792, but not more than 25 p. deal with the xvth cent.

G. S.

Loria, Gino The debt of mathematics to the Chinese people. *Scientific monthly*, t. 12, p. 517-521, 1921. 1918

Abridged translation by R. B. McCLENNON of LORIA's paper 1920 (*Isis* III, 470), based chiefly on MIKAMI, 1912. G. S.

Pelliot, Paul. Les grottes de Touen-Houang. Peintures et sculptures bouddhiques des époques des Wei, des T'ang et des Song. 2 vol. (Mission PELLIOT en Asie Centrale, I). Paris, GEUTHNER, 1914-1920.

1818

Saussure, Léopold de. Le cycle des douze animaux et le symbolisme cosmologique des Chinois. *Journal asiatique*, t. XV, p. 55-88, 1920.

1818

Les principes cosmologiques. Les cycles zoaires primordiaux. Le cycle des douze animaux. La conclusion de l'auteur, c'est qu'il existe un symbolisme zoaire chinois (de ce que la série duodénaire ne date en Chine que du premier siècle et de ce que les Turco-mongols l'ont en prédilection, CHAVANNES avait conclu, en 1906, qu'elle avait été importée en Chine par les peuples turcs). « Sa caractéristique, c'est que chacun de ses termes représente une phase dans l'espace ou dans le temps, de la révolution dualistique (du *yin* et du *yang*). Cette révolution est conçue d'après un type unique pouvant s'appliquer à toutes les révolutions de la nature, annuelle, diurne, sidérale, azimutale. Les cycles zoaires de 4, 6, 8 et 12 termes représentent divers modes de division de cette révolution cosmologique. Le cycle de 4 termes date de la plus haute antiquité. Les cycles de 6 et 8 termes sont antérieurs au Tcheou... Ces trois cycles primordiaux se manifestent dans la littérature canonique et classique. Le cycle des 12 animaux n'apparaît explicitement qu'au début de notre ère, mais on en aperçoit des indices sous la dynastie Tcheou. La répartition de ses termes démontre qu'il a subi une réforme d'ordre astronomique, avant l'époque où il apparaît dans la littérature. Le dérangement survenu dans la distribution originelle des animaux fournit l'explication de l'ordre de numération des anciens mois turcs ».

G. S.

Stein, Sir Aurel. Serindia. Detailed report of exploration in Central Asia and Westernmost China. Carried out and described under the orders of H. M. Indian government, 5 vol. royal in 4^e. LXX + 1580 p., 175 pl., 345 ill. etc. Oxford, Clarendon Press, 1921. [12 guin.].

1818

Swingle, Walter T. Far Eastern acquisitions. *Report of the Librarian of Congress* for the year 1920-1921, p. 169-175, Washington, 1921.

1818

The Far Eastern collections of the Library of Congress are growing fast. Among the latest acquisitions of Chinese books let us quote : some more official gazetteers, the L. C. having now a total of 1,047 different official gazetteers; a Ming edition in 100 books of the *Yao shan t'an wai chi*, a biographical compilation by the Ming author CHIANG I-K'UEI; a modern biographical dictionary, the *Chung kuo jên ming ta ts'u tien* issued in 1921, 1,981 p., 42,000 biographies; 37 new *ts'ung shu* (collections of reprints), of which there are now in the library 310 different ones containing well over 10,000 different works. Two of these *ts'ung shu* are of particular interest : the *Yao lü ch'ian shu* compiled by the Ming prince CHU TSAI-YÜ and published in 1610, a collection of mathematical treatises on music, and the *Si yang hsin fa li shu* by ADAM SCHALL (T'ANG JO-WANG). NICOLAS LONGOBARDI, JEAN TERRENZ, JACQUES RHO and other Jesuit missionaries, a collection of mathematical and astronomical treatises published about 1630 (the set of the L. C. is not complete; it contains 24 works in 63 books).

G. S.

8. — EGYPT.

Borchardt, Ludwig. Die Geschichte der Zeitmessung und der Uhren, herausgegeben von ERNST VON BASSERMANN-JORDAN. Band I, Liefere-

rung B : Altägyptische Zeitmessung, Berlin und Leipzig 1920, IV^o 70 B. 1818

Das Werk wird im Ganzen 7 Lieferungen enthalten, und jeder einzelne Teil wird von einem Spezialforscher bearbeitet. Der Inhalt vorliegender, auf gründlichsten Quellenstudien an Ort und Stelle basierenden Abhandlung ist der folgende : 1. Die ägyptischen Zeitmasse. — 2. Die ägyptischen Zeitmesser : a) die Wasseruhren [Auslauf- und Einlaufuhren]; b) die Sonnenuhren [Messen der Schattenlänge, Sonnenuhren mit wagerechter Auffangfläche, Sonnenuhren mit gestufter Auffangfläche, Sonnenuhren mit schräger Auffangfläche, Streiflichtsonnenuhren mit schräger Auffangfläche; Sonnenuhren mit senkrechter Auffangfläche]; c) Sternenuhren. — 3. Schluss (Rückblick auf die verschiedenen Arten der ägyptischen Zeitmesser und Vergleich derselben). — 4. Nachtrag (Älteste inschriftliche Erwähnung der Auslaufuhr; Grabinschrift ihres Erfinders).

Das vornehm ausgestattete Buch mit seinem reichen Bilders Schmuck von altägyptischen Original-Zeitmessern, gibt zum ersten Mal eine Darstellung dieses interessanten Gebietes altägyptischer Chronologie und Zeitmessung nach den Quellen und ist daher eine Fundgrube ersten Ranges in einem bis jetzt so gut wie unbekannten Wissenszweig des altherwürdigen Pharaonen-volkes. C. SCHÖY.

Hopfner, Theodor. Der Tierkult der alten Ägypter nach den griechisch römischen Berichten und den wichtigeren Denkmälern. *Denkschriften der Akad. d. Wiss. in Wien, philos.-hist. Klasse*, 57. Bd., 2. Abh., 201 p., Wien 1914. 1818

An elaborate survey of this subject, which may interest the historian of zoology. The main subdivision is zoological, 36 successive chapters being devoted to as many species (n^o 19 is devoted to the okapi). G. S.

Knight, G. A. Frank. Nile and Jordan. Being the archaeological and historical interrelations between Egypt and Canaan from the earliest times to the fall of Jerusalem in A. D. 70. London. CLARKE, 1921. 1818

Ricci, Seymour de. Esquisse d'une bibliographie égyptologique. *Revue archéologique*, t. 6, p. 197-212, 374-391; t. 7, p. 158-176. Paris, 1917-1918. 1818

A list of the essential books on Ancient Egypt (Greco-Roman and Coptic antiquities excluded); there are but very few critical notes. G. S.

Richards, F. S. Note on the age of the great temple of Ammon at Karnak as determined by the orientation of its axis. Cairo, Government Press, 1921. 1818

Reviewed by H. G. Lyons in *Nature*; t. 108, p. 587, 1921. G. S.

Ruffer, Sir Marc Armand (1859-1917). Studies in the palaeopathology of Egypt. Edited by Roy L. MOODIE, xx + 372 p., 71 pl. Chicago, University Press, 1921. 1818

Sethe, Kurt. Die Zeitrechnung der alten Ägypter im Verhältnis zu der der andern Völker. Eine entwicklungsgeschichtliche Studie. *Nachrichten, Kgl. Ges. d. Wiss. zu Göttingen, phil. Kl.*, p. 287-320, 1919. 1818

Sonne und Mond als Zeitmesser. Das Natur- oder Bauernjahr. Das Fixsternjahr. Die Jahreszeiten. Das Mondjahr. Das Rumpfsjahr von 360 Tagen. Das Wandeljahr von 365 Tagen. Das feste Jahr. Die Ausbreitung des ägyptischen Jahres ausserhalb Ägyptens.

9. — GREECE.

Bidez, J. Projet d'un catalogue des manuscrits alchimiques présenté à l'Union académique internationale. *Bull. de la Classe des lettres de l'Acad. de Belgique*, p. 677-684, 1919. 1818

Custance, Admiral Sir Reginald. War at sea. Modern theory and ancient practice, xi + 113 p., 12 plans and charts. Edinburgh, BLACKWOOD, 1919. 1818

“ The wars of the ancient Greeks have been used to illustrate the theory, because the theatre of those wars being narrow, and the conditions of life comparatively simple, the working of the great drama can in each case be clearly followed. Moreover, those wars are good examples of the interdependence of the action by sea and by land ”.

Farnell, L. R. Greek hero cults and ideas of immortality (Gifford lectures, University of St. Andrews, 1920). Oxford, Clarendon Press, 1921. 1818

Glötz, Gustave. Le travail dans la Grèce ancienne, 468 p., 49 grav. Paris, ALCAN, 1920. 1818

Reviewed by VICTOR CHAPOT in *Revue de synthèse historique*, t. 32, p. 109-114, 1921.

Heiberg, J. L. Les sciences grecques et leur transmission. I^{re} partie : Splendeur et décadence de la science grecque; II^e partie : L'œuvre de conservation et de transmission des Byzantins et des Arabes. Bologna, *Scientia*, t. 31, p. 1-11, 97-105; janvier et février 1922. 1818

Homolle, Théophile. Ressemblance de l'omphalos delphique avec quelques représentations égyptiennes. *Revue des études grecques*, t. 32, p. 338-358, 12 fig., 1919. 1818

Kalinka, Ernst. Der Ursprung der Buchstabenschrift. *Klio*, t. 16, p. 302-317, 1920. 1818

“ Die Buchstabenschrift ist eine Schöpfung der alten Griechen. Es war die erste Grosstat des griechischen Geistes, der noch viele andere folgten, und begründete zusammen mit ihnen jene Kultur, in der die heutige wurzelt ”. G. S.

Petersen, Eugen. Rhythmus. *Abhdl. d. Kgl. Ges. d. Wissenschaften zu Göttingen*, Bd. 16, No. 5, 104 p. Berlin, 1917. 1818

Moderner Gebrauch des Wortes Rhythmus. Ursprung und Bedeutung des griechischen Wortes. ARISTOXENUS Theorie. Einwirkung des Rhythmus auf die Bewegung. ARISTOXENUS und die moderne Physiologie. PYTHAGORAS und MYRON um Rhythmus gelobter Meister der Plastik. Rhythmus in der MYRON gleichzeitigen Malerei und Skulptur. Nach der rhythmischen die ethische Kunst, besonders in Olympia. Von Olympia nach Athen, zur Vollendung in Ethos und Rhythmus. Rhythmus in vor- und nachgriechischen Kunst.

Wright, Jonathan. The origin of Hippocratic theory in some of the science of the nature philosophers. *Scientific monthly*, t. 11, p. 127-140, 1920. 1818

10. — INDIA.

- Acharya, Prasanna Kumar.** A treatise on architecture and kindred subjects. Thesis for the degree of Ph. D. of the East Indian Archipelago at the University of Leiden. Leiden, BRILL, 1918. 1818

Deals chiefly with the Manasara, an important Sanskrit text probably older than the viii century, and treating of architecture and iconography. Review in *Rupam*, N° 4. A. K. C.

- Bhagavan, Das.** Hindu-Aryan astronomy and antiquity of Aryan race by PANDIT BHAGWAN DAS PATHAK. iv + 118 p. Dehra Dun, Gahrwali Press, 1920. [2 rupees]. 1818

The author is convinced that Hindu astronomy is of considerable antiquity (the five major planets being known to them at least as far back as 5000 B. C.) and precision (data concerning the moon's sidereal motion dating from 1905 B. C., if applied to computations relative to 1850 A. D., give results agreeing exactly with those of European astronomers!). The object of his investigations has been chiefly to prepare the rectification of the Hindu calendar. G. S.

- Bhagavan, Das.** Antiquity of Aryan race, x + 102 p. Dehra Dun, U. P., Garhwali Press, 1922. [2 rupees]. 1818

This is a sequel to the book on *Hindu-Aryan astronomy and antiquity of Aryan race*. A study of the constellations has led him to make some very remarkable discoveries, to wit: the ancients originally formed some constellations in c. 120,394 B. C.; the deluge took place and the ancients emigrated to 70 or 69 degrees of N. latitude in c. 86,469 B. C., etc. G. S.

- Bhagavan, Das.** La science des émotions, 206 p. Bruxelles, Librairie théosophique, 1921. 1818

- Bloomfield, M.** The life and stories of the Jaina savior PĀRŚVANĀTHA. xii + 254 p. Baltimore. JOHNS HOPKINS Press, 1919. 1818

- Cohn, W.** Indische Plastik, vii + 87 p. 161 pl. Berlin. BRUNO CASSIRER 1921. 1818

An excellent collection of photographic reproductions of Indian and Indonesian sculpture. With a lengthy introduction (partially translated into English in a long review in *Rupam*, N° 7). Dr. COHN dissents from the exaggerated views of some authors as to the extent and importance of Greek influences in Indian art. Of Plate 120, the original is still at Anurādhapura, not in the Colombo Museum. A. K. C.

- Coomaraswamy, A. K.** Saiva sculptures (recent acquisitions). *Museum of Fine Arts Bulletin*, N° 118, p. 15-24, 10 fig. Boston, 1922. 1818

- Duff, James Cuninghame Grant** (1789-1858) A history of the Mahrattas. Revised annotated edition with an introduction by S. M. EDWARDS. 2 vol. xxi + 586, xxii + 574 p., po trait, map. Oxford University Press, 1921. 1818

- Farquhar, J. N.** Outline of the religious literature of India, xxviii + 451 p. Oxford. University Press, 1920. 1818

- Foucher, A.** The Beginnings of Buddhist art, ix + 293 p., 50 pl. Paris. GEUTHNER, 1917 (and issued to members of the India Society, London). A collection of essays transl. by L. A. and F. W. THOMAS. 1818

Essays entitled: the beginnings of Buddhist art; the representation of

'Jātakas' on the reliefs of Barhut; the Eastern gate of the Sānchi stūpa; the Greek origin of the image of BUDDHA; the Tutelary Pair in Gaul and in India; the Great Miracle at Śrāvastī; the Six-tusked Elephant; Buddhist art in Java; the Buddhist Madonna. Learned and illuminating, indispensable to students of Indian art. But FOUCHER accuses those who do not agree with him as to the extent and importance of the Hellenistic elements in Indian art, and deny the "manifest superiority" of Gandhara sculptures, aesthetic perversity or nationalist rancour. This is scarcely an adequate substitute for argument.

A. K. C.

Konow, Sten. The Aryan gods of the Mitani people. *Roy. Fred. Univ. Pub. of the Indian Institute*, N° 1, 39 p., Kristiania, 1921. ISIS

"The Mitani gods were Indian and not Aryan": hence, "the sphere of Indian civilisation had, in the middle of the second millennium B. C., extended into Mesopotamia".

A. K. C.

Law, Narendra, Nath. Aspects of ancient Indian polity. With a foreword by ARTHUR BERRIEDALE KEITH. XX + 228 p. Oxford, Clarendon Press, 1921. ISIS

Forms and types of states. The state-council. The royal priest. Regal succession. The education of the prince. The royal duties: the king's daily routine of work. The evolution of the principal state officials. Theories of the evolution of kingship among the Indo-Aryans. The religious aspects of ancient Hindu polity. Index.

Meyer, Johann Jacob. Das Weib im altindischen Epos. Ein Beitrag zur indischen und zur vergleichenden Kulturgeschichte, XVIII + 440 p. Leipzig, HEIMS, 1915. ISIS

See review by JARL CHARPENTIER in *Z. d. deut. morg. Ges.*, t. 70, p. 264-269, 1916. G S.

Nahar, P. G. and Ghosh, K. Epitome of Jainism, XVII + XXX + 706 + LXXVII p., 10 pl. Calcutta, GULAB KUMAR library, 1917. ISIS

Best general account of the Jain system.

A. K. C.

Oldenberg, Hermann. Die Lehre der Upanishaden und die Anfänge des Buddhismus, 374 p. Göttingen, VANDENHOECK und RUPRECHT, 1915. ISIS

Reviewed by R. OTTO FRANKE in the *Ostasiatische Z.*, t. 7, p. 242-244, 1919.

Pillai, L. D. S. Indian chronology, II + 233 + XII p. Madras, GRANT, 1911. ISIS

Comparative tables of eras, and astronomical data.

A. K. C.

Popley, H. A. Music of India. Calcutta and Oxford, 173 p., 1921. ISIS

A succinct and trustworthy survey, with some examples. A very sympathetic as well as learned account of a great and living culture.

A. K. C.

Pratinidhi, Bhavanrao. The lines to be followed in drawing the pictures for the Mahābhārata edition, p. 1-34 with ten plates. *Annals of the Bhandarkar Instituts*, Poona, Vol. III, pt. 1, 1921. ISIS

A discussion of ancient Indian costume, based on the sculptures.

A. K. C.

Rao, T. A. Gopinatha Talamana or Iconometry. *Mem. Arch. Sur. India* n° 3, 115 p. 13 pl., Calcutta, Government printer, 1920. 1818

Detailed study of the proportions of images. No reference to previously published literature. A. K. C.

Rao, T. A. Gopinatha Elements of Hindu Iconography. Vol. I, xviii + 400 + 160 p., 122 pl.; vol. 2, xi + 578 + 279 + 37 p., 159 pl., Madras, Law Printing House, 1914-1916. 1818

Exhaustive and fully illustrated, plates many and well chosen, but badly reproduced : with texts from Śilpa Śāstras. A. K. C.

Rodin, A. ; Coomaraswamy, A. ; Havell, E. B. ; Goloubew, V. Sculptures égyptiennes de l'Inde. *Ars Asiatica*, vol. 3, 31 p. 47 pl. Bruxelles et Paris, VAN OEST, 1921. 1818

Natarāja : Elephanta (Trimūrti) : Mahābalipūram. Excellent plates giving many details separately. A. K. C.

Santideva Śikshāsa-Muccaya. A compendium of Buddhistic doctrine compiled chiefly from the earlier Mahayana Sūtras. Translated from the Sanscrit by the late CECIL BENDALL and W. H. D. ROUSE. London, MURRAY, 1922. 1818

Sen, Dinesh Chandra History of Bengali language and literature. xiii + 1030 p., 9 pl., Calcutta, University, 1911. 1818

Invaluable for general study of Hindu civilisation, as well as Bengali literature in particular. A. K. C.

Sen, Dinesh Chandra Folk literature of Bengal, xxix + 362 p. Calcutta, University, 1920. 1818

Woodroffe, Sir John Bharata Shakti. Collection of addresses on Indian culture. Third and enlarged edition. xlviii + 132 p. Madras, GANESH, 1921 [1st ed., 1917]. [Re. 1-8.] 1818

Addresses by an English judge in India who is an enthusiastic and generous defender of Hindu culture. " India is not a mere geographical expression nor a mere congeries of people.. India is an idea. It is a particular Shakti, the Bharata Shakti, distinguished from all others by Her own peculiar nature and qualities. No home is a truly Indian home, which is not Her expression. The basis of all culture and the maker of all nationality is Religion... May the great and wonderful antique life of India be reborn in the forms of to-day. " G. S.

Woodroffe, Sir John The world as power reality. 118 p. Madras, GANESH, [1921]. [2 Rs.] 1818

The first booklet of a series explaining succinctly some general philosophical principles of the Doctrine of Shakti or Power from the Shakti Vedānta standpoint. Hindu philosophy and religion are too often treated in an archaeological way. The author's aim on the contrary is to state general principles with reference to the thought of to-day. G. S.

Woods, J. Haughton La théorie de la connaissance dans le système du Yoga. *Journal Asiatique*, t. 11, p. 385-389, 1918. 1818

11. — IRAN.

Hodivala, Shahpurshah Hormasj Studies in Parsi history. 350 p. Bombay, 1920. 1818

Sykes, General Sir Percy. A history of Persia, 2 vol., second edition. London, MACMILLAN, 1921. 1818

12. — ISLAM.

Basset, Henri. Essai sur la littérature des Berbères, 446 p. Alger, JULES CARBONNEL, 1920. 1818

Les origines de la langue et l'alphabet national (alphabets libyque, tinfinagh, ce dernier en usage chez les Touaregs du Sahara). Le Berbère et sa langue. Littérature écrite (le plus ancien document cité est le *Qoran* composé en 127 A. H. par SALIH BEN TARIF de la tribu des Berghouata. Littérature juridique. Littérature orale (Contes et légendes; poésie). Index avec la transcription des noms en caractères arabes. G. S.

Campani, Romeo. Calendario Arabo. Tabelle comparative delle Ere Arabo e Cristiano-Gregoriana mese per mese (Ègira 1-1318) e giorno per giorno (E. V. 1900-2000). 151 p. Modena, Società tipografica modenese, 1914. 1818

These tables published for the General Staff of the Italian army are very convenient and very inexpensive as compared with the tables of FERN. WÜSTENFELD (Leipzig 1854) continued by MAHLER (1887) or those of DE MAS LATRIE (*Trésor de chronologie*, Paris 1889). I have used both the German and the Italian tables and can testify to the greater convenience of the latter. It would be well, however, to add at the beginning a shorter table year by year. R. CAMPANI explains the Arabic and Turkish calendars in his Introduction and gives a bibliography of the subject. G. S.

Carra de Vaux, Baron. Les penseurs de l'Islam. I. Les souverains, l'histoire, la politique et la philosophie, VII + 383 p. Paris, GEUTHNER, 1921. 1818

Le premier d'une collection de cinq volumes dont le but est de vulgariser la connaissance de la pensée musulmane. L'érudition de ce livre est dissimulée sous les dehors d'une prose aimable; l'auteur n'a point essayé d'épuiser le sujet, ce qui l'aurait conduit à écrire une sorte de catalogue, mais plutôt d'offrir un choix, le fruit d'une longue expérience : (1-2) Souverains; (3-4) Historiens arabes; (5) Historiens persans et historiens des Mongols; (6) Historiens turcs; (7) Philosophie politique; (8) Proverbes et contes. Il semble que ce livre ait été écrit avec trop de hâte; l'emploi capricieux des dates chrétiennes et musulmanes est ennuyant. G. S.

Dinet, E. et Sliman ben Ibrahim. L'Orient vu de l'Occident. Essai critique avec un dessin facsimilé de E. DINET, 105 p. Paris, H. PIAZZA et P. GEUTHNER [sans date, 1922]. 1818

Ce pamphlet fort intéressant fut rédigé à Bou-Sâada en septembre 1921; il est consacré surtout à la critique des œuvres du P. LAMMENS et du livre de CASANOVA, professeur au Collège de France, sur MOHAMMED et la Fin du Monde. Le point de vue d'E. DINET (*alias* NASR-ED-DINE) et SLIMAN BEN IBRAHIM est celui de l'Islam. La science du P. LAMMENS ne peut être mise en doute, mais ce savant apologiste a une tendance déplorable à remplacer les arguments scientifiques par des insultes ou des insinuations. CASANOVA, au contraire, fait preuve d'impartialité et de ce minimum de sympathie sans lequel il est impossible de comprendre la pensée d'autrui. Sa thèse, c'est que le Prophète croyait que la fin du monde était proche et qu'il y assisterait; c'est pour cela qu'il ne désigna pas de successeurs. Les auteurs discutent cette thèse qui leur paraît inexacte. Au P. LAMMENS, qui paraît dépourvu de charité chrétienne, il serait peut-être bon de rappeler ce précepte de la charité musulmane : « Ne disputez sur la Religion, avec les gens du Livre, qu'avec la plus grande courtoisie ». (*Coran.*) G. S.

Gaudefroy-Demombynes, Maurice. Les institutions musulmanes, 192 p. Paris, FLAMMARION, c. 1921. 1818

Horten, Max. Die religiöse Gedankenwelt des Volkes im heutigen Islam. 2 parts. Halle a. S. NIEMEYER, 1917-1918. 1818

A study completing that previously published by the same author, 1916 (*Isis*, IV, 183); popular vs. philosophical religion. G. S.

Kappauf, Willy. Aus der Zahnheilkunde der Araber in der Überlieferung des Abendlandes. (*Diss.*; SUDHOFFS Institut), 80 p. Mannheim, 1921. 1818

A summary of Muslim dentistry, including many extracts from the sources and a bibliography. G. S.

Nicholson, Reynold A. Studies in Islamic poetry, xii + 300 p. Cambridge, University Press, 1921. 1818

[**Transliteration**]. Transliteration of Arabic and Persian. Report of the committee appointed to draw up a practical scheme for the transliteration into English of words and names belonging to the languages of the nearer East. *Proc. of the British Academy*, p. 505-521, 1917-1918. 1818

The committee included : Sir CHARLES LYALL, A. A. BEVAN, T. RHYS DAVIDS, D. S. MARGOLICUTH, Sir FREDERICK POLLOCK, HINKS. Aims : uniformity; avoidance as far as possible of diacritical marks; conformity as far as possible to English usage. G. S.

Wiedemann, Eilhard und Hauser, Fritz. Über die Uhren im Bereich der islamischen Kultur., *Nova Acta*, Bd. 100, p. 272. Halle 1915. 1818

A very elaborate description and discussion of the clocks used by the Muslims, chiefly the waterclocks (sundials are not dealt with; for sundials see C. SCHÖY, Arabische Gnomonik, *Archiv der deutschen Seewarte*, Bd. 36, 1913). The chief part of this long memoir is furnished by the translation of two Arabic works of the beginning of the ninth cent. :

1. The *Kitāb fi ma'rīfat al-hijāl al-handasiya*, that is, the book on the knowledge of geometrical ingenious (mechanical) devices which was completed in 1206, by ABU'L-'IZZ ISMA'IL IBN AL RAZZAZ (son of the rice merchant) AL GAZARI (the Mesopotamian) BADI' AL ZAMĀN (the peerless one of his time). This AL-GAZARI fl. in the period 1181-1205 under the Urtuqides who ruled in Kafā, Māridīn and Dījār Bekr; he mentions a door in Amid, the capital of Dījār Bekr, on the Tigris. The translation of this book covers pp. 58 to 166.

2. Book on the construction and use of the clock of the BĀB GAIHŪN, by RIDWĀN IBN MUHAMMAD AL-CHURĀSĀNĪ RIDWĀN IBN MUHAMMAD IBN 'ALĪ AL-CHURĀSĀNĪ (abbreviated translation p. 176-266). This book was completed in 1203. GAZARI's book spoke only of clocks to be used inside of palaces or else by travellers. RIDWĀN's book, on the contrary, was devoted to a famous public clock which was placed outside of the Bāb Gairūn (or Bāb al Sā'at, door of the clock) in Damascus. RIDWĀN's father, MUHAMMAD IBN 'ALĪ IBN RUSTAM AL-CHURĀSĀNĪ AL-SĀ'ATĪ (the clockmaker) had constructed this clock sometime between 1146 and 1169. Sometime between 1166 and 1169 it was repaired and improved. It was seen and described by many travellers (IBN GUDAIR, 1184; QAZWĪNĪ; IBN BATŪTA; etc.). WIEDERMANN's memoir is an important contribution to the history of Muslim technology. It is more comprehensive than its title suggests;

for it contains information on many other objects than clocks, ex. gr. weights and measures, and incidentally on Muslim civilization.

The upshot of this investigation is that the Muslims had used their Byzantine models with considerable advantage. Their clocks testify to their great technical skill and help us to realize that the Muslims were able to construct excellent astronomical instruments and to make observations of remarkable precision.

G. S.

Wiedemann, E. und Hauser, F. Uhr des ARCHIMEDES und zwei andere Vorrichtungen. *Nova Acta*, Bd. 103, p. 163-202. Halle, 1918. ISIS

The writing entitled "the Clock of ARCHIMEDES" was made known in 1891 by CARRA DE VAUX (*Journal Asiatique*, t. 17, 287). WIEDEMANN and HAUSER give us now a complete translation of this Arabic text, based upon the best MSS. This text is of Byzantine origin and many Persian words suggest that it was transmitted to the Arabs by Persians. Together with VITRUVIUS' account of CRESIBIUS' clock it gives us a good idea of ancient clocks. A writing on the clock is mentioned in the Fihrist (p. 266), being attributed to IBN ISHĀQ AL-NADĪM (d. 995). The authors give also a short account of two other writings on clocks contained in the Bodleian MS. 954.

G. S.

13. — ISRAEL.

(See also Bible.)

Browne, Laurence E. Early Judaism, xiv + 234 p. Cambridge, University Press, 1920. ISIS

Cohen, Abraham. The Babylonian Talmud. Tractate Berākōt. Translated into English for the first time, with introduction, commentary, glossary and indices, 500 p. Cambridge, University Press, 1921. ISIS

Gollancz, Hermann. Sepher Maphteah Shelomo (Book of the key of Solomon). An exact facsimile of an original book of magic in Hebrew, with illustrations, xix p. + 79 folios in facsimile. Oxford University Press 1914 (300 copies). [2 guin.] ISIS

This MS., in the author's possession, is dated 1700 and is written in the Hebrew cursive script of an Italo-Spanish character. It is of interest to the folk-lorist and to the historian of science, for it contains references to philosophy, medicine, alchemy, astronomy, mathematics, theology, physiognomy, logic, music, politics. Solomon plays the same rôle in ancient Jewish magic as FAUST does in the Christian; the *Clavicula Salomonis* is supposed to be the source of all Jewish books on magic. Until about 1903 it was thought that the Hebrew text was lost. The present MS. offers the most complete version. A few fragments are transcribed in square Hebrew character and translated into English. For a longer analysis see the author's previous brochure *Clavicula Salomonis*, Frankfurt, KAUFFMANN, 1903.

G. S.

Kallen, Horace Mayer. Zionism and world politics. A study in history and social politics. New York, DOUBLEDAY; London, HEINEMANN, 1921. ISIS

Swift, Flechter A. Education in ancient Israel from earliest times to 70 A. D., XII + 134 p. Chicago, Open Court, 1919. ISIS

15. — MIDDLE AGES.

Brodmann, Carl. Deutsche Zahntexte in Handschriften des Mittelalters (*Diss.*, Sudhoffs Institut), 71 p. Wittenberg, Herrosé und Ziemsen, 1921. 1818

The first printed book on dentistry is the *Artzney buchlein wider allerlei krankheyt und gebrechen der Czeen*, Leipzig 1530, by an unknown physician of Mittweida, Saxony, but this book had been preceded by MSS. texts, 8 of which are here reproduced and annotated with technical index and bibliography. G. S.

Cumont, Franz. Astrologica. *Revue archéologique*, t. III, p. 1-22, Paris, 1916. 1818

A propos : d'une miniature astrologique des célèbres *Heures du duc de Berry* conservées à Chantilly; de deux manuscrits latins du ix^e siècle contenant des images des deux hémisphères célestes (BOLL avait déjà publié un MS. grec de la même époque dans lequel le ciel était aussi divisé en deux hémisphères); d'un MS. astrologique latin du x^e siècle (Parisinus 17.868), dont le contenu est brièvement analysé. Ce dernier MS. est d'autant plus intéressant que si l'on excepte les MSS. de MANILIUS et de FIRMICUS MATERNUS, « il n'existe pour ainsi dire aucun MS. latin relatif à l'astrologie qui soit antérieur à la seconde moitié du xiii^e siècle, époque où commencent à se multiplier les traductions de l'arabe ». G. S.

Hartmann, Friedrich. Die Literatur von Früh- und Hochsalerno und der Inhalt des « Breslauer Codex Salernitanus » mit erstmaliger Veröffentlichung zweier Traktate aus dieser Handschrift : [Anonymus]: « De morbis quattuor regionum corporis » [Ursonis]; « De saporibus et numero eorum »; samt Wiederabdruck der Schrift: « De observatione minutionis » (*Diss.*, Leipzig), 70 p. Borna-Leipzig, R. Noske, 1919. 1818

The texts quoted in the title are printed on p. 53-58. The rest of this little work is a very clear summary of Salernitan medicine, — an excellent primer on the subject. The 43 first pages deal briefly with the main personalities of the early and later Salernitan schools. Then follow an account of the famous Breslau MS.: table of contents; which parts of it were already known through other Salernitan collections?; which parts are new?; which parts have already been published?; which are still unpublished? This very useful little book ends with a catalogue of Salernitan writings classified by subjects. G. S.

Leach, Henry Goddard. Angevin Britain and Scandinavia, xii + 432 p. Cambridge, Mass., Harvard University Press, 1921. 1818

Poole, Reginald Lane. Illustrations of the history of medieval thought and learning. Second edition revised, xiv + 328 p. London, S. P. C. K., 1920. 1818

First published in 1884.

[*Regimen Sanitatis Salernitanum*] The School of Salerno, « Regimen sanitatis salernitanum » The English version by Sir JOHN HARRINGTON. History of the school of Salerno by FRANCIS R. PACKARD and a note on the prehistory of the « Regimen sanitatis » by FIELDING H. GARRISON, 215 p., ill. New York, HOEBER, 1920. 1818

Schmeidler, Bernhard. Hamburg-Bremen und Nordost-Europa vom 9. bis 11. Jahrhundert. Kritische Untersuchungen zur Hamburg-

gischen Kirchengeschichte des ADAM von Bremen; zu Hamburger Urkunden und zur Nordischen und Wendischen Geschichte, xx + 363 p. Leipzig, DIEDERICH, 1918. 1818

Sudhoff, Karl. Eine niederländische Uebersetzung des frühmittelalterlichen Leitfadens für die Kinderpraxis. *Janus*, t. 24, p. 218-221, 1919. 1818

Dutch translation of this early medieval text, edited from Cod. lat. Vindobonensis 2818, fol. 268v-269r, dated from the beginning of the xvth cent. G. S.

Tout, Thomas Frederick. Medieval and modern warfare. Lecture, 30 p. *Bull. of the JOHN RYLANDS Library*, vol. 5, 1919. 1818

16. — ROME.

Besnier, Maurice. Le commerce du plomb à l'époque romaine d'après les lingots estampillés. *Revue archéologique*, t. 12, p. 210-244, 1920. 1818

Fowler, W. Warde. Ancient Italy and modern Borneo: a study in comparative culture. *Journal of Roman studies*, vol. 6, p. 13-26, London 1916. 1818

Comparison suggested by the publication in 1912 of HOSE and Mc DOUGALL, the Pagan tribes of Borneo. The author shows that there are many point of resemblance in the mentality of the peoples of modern Borneo and ancient Italy. G. S.

Hill, G. F. The mints of Roman Arabia and Mesopotamia. *Journal of Roman studies*, vol. 6, p. 135-169, 2 pl. London, 1916. 1818

Jacobi, H. Führer durch die Saalburg und ihre Sammlungen, ix. Auflage mit 18 Textabb, 56 p. Homburg v. d. H. 1921. 1818

A short guide prepared by the Director of the Saalburg Museum for the visitors to the Saalburg fort on the Taunus near Homburg, which was an important point of the "limes germanicus". History and description of the fort, the various encampments, the museum, the Mithraic sanctuary, etc. For more technical information one should refer to the *Saalburg-Jahrbücher*, published since 1910 (vol. 5 will possibly appear in 1922). For the ballistic engines see SCHRAMM under Antiquity. G. S.

Jeanselme, E. Quelle était la ration alimentaire du citoyen, du soldat et de l'esclave romains? 31 p. *Bulletin de la Société scientifique d'hygiène alimentaire*, 1918. 1818

Jeanselme, E. De la protection de l'enfant chez les Romains, II + 94 p. Paris, Masson, 1917. 1818

Etude fort claire et concise de l'évolution de la famille romaine depuis les origines jusqu'à la mort de JUSTINIEN, du point de vue spécial de l'enfant. Durant ces treize siècles nous assistons à une transformation graduelle mais radicale de la famille: au début, le "pater familias" exerce un pouvoir absolu sur sa descendance; à la fin, grâce à l'adoucissement des mœurs et surtout à l'influence du Christianisme, le despotisme du père a été brisé, la famille antique s'est désagrégée, — la famille moderne est née. "La continence et la stérilité volontaire, l'avortement, l'infanticide, l'abandon des nouveaux nés, la castration, sont, selon l'époque, approuvés par la loi, autorisés par elle, mais condamnés par l'opinion publique, ou réprimés avec la dernière rigueur. En sorte que le même acte, licite sous les rois, parce

qu'il découle de l'exercice d'un droit, est tenu pour répréhensible au nom de l'humanité et de la morale vers la fin de la République, et même qualifié délit ou crime sous les premiers empereurs chrétiens ». Un passage intéressant de cette histoire est celui qui concerne le développement aux premiers siècles de notre ère des « organotrophes » (orphelinats); ceux-ci prirent une rapide extension sous CONSTANTIN. G. S.

Jeanselme, E. Des mendiants et des mesures prises contre eux sous le Bas-Empire. *Revue philanthropique*, t. 38, p. 361-365. 1878

Kubitschek, Wilhelm. Die Kalenderbücher von Florenz, Rom und Leyden. *Denkschriften der K. Akad. d. Wiss. in Wien. phil. Kl.*, 57. Bd., 3. Abh., 119 p. Wien, 1915. 1875

Text der Monatstafeln des Laurentianus xxviii 26 und der Leydener Hdsch. Text der Monatstafeln der vatikanischen Hdsch. Vergleichung des römischen mit dem ägyptischen und dem hellenischen (antiochenischen) Kalender. G. S.

Morin-Jean. La verrerie en Gaule à l'époque impériale romaine. Préface d'ERNEST BABELON, xi + 308 p., 353 grav., 10 pl. Le Mans, (*VIII^e Congrès préhistorique de France*, 1912, p. 805-821). MONNOYER, 1913. 1818

Sandys, Sir John Edwin (editor). A companion to Latin studies. Third edition, xxxv + 891 p. Cambridge, University Press, 1921.

First ed. 1910; Second 1913. This third edition is substantially the same as the second, though not inconsiderable changes have been made to the sections devoted to Topography of Rome, Flora, Epigraphy. G. S.

PART III.

Systematic Classification.

Containing only the materials which could not be included in the two previous parts : centuriat and historical. The topics are classified in alphabetic order.

3 — ARCHAEOLOGY.

(Museums and collections.)

Gautier, E. F. Les premiers résultats de la mission FROBENIUS. *Revue africaine*, 16 p. Alger, 1921. 1816

Critique violente du mémoire de FROBENIUS. « Der klein afrikanische Grabbau. Prehistorische Zeitschrift 1916 » se terminant par un plaidoyer pour la création d'une chaire d'éthnographie et de préhistoire à l'Université d'Alger. G. S.

Loir, A. et Legangneux. Précis de Muséologie pratique, 107 p., in-16. Le Havre, Museum d'Histoire naturelle, 1921. 1813

4. — ART. ART and SCIENCE. ICONOGRAPHY.

Jackson, Sir Thomas Graham. Byzantine and Romanesque architecture. 2 vol. Cambridge, University Press, 1913. (Second edition, 1920.) ISIS

Strzygowski, Josef. Ursprung der christlichen Kirchenkunst Neue Tatsachen und Grundsätze der Kunstforschung, xi + 204 p., 36 pl., 64 ill. (*Arbeiten des kunsthistorischen Instituts der Universität Wien*, 15) Leipzig, HINRICHS, 1920. ISIS

Ward, James. History and methods of ancient and modern painting, 4 vol. London, CHAPMAN and HALL, 1913-21. ISIS

5. — ARTS and CRAFTS.

Baker, Oliver. Black Jacks and leather bottles. Being some account of leather drinking vessels in England and incidentally of other ancient vessels. Privately printed for W. J. FIELDHOUSE by ED. J. BURROW, London, 1921. ISIS

Burton, William. A general history of porcelain, 2 vol. London, CASSELL, 1921. ISIS

6. — ASTRONOMY, GEODESY, METEOROLOGY
and TERRESTRIAL PHYSICS.

Curtiss, R. H. An account of the rise of navigation. *Popular Astronomy*, vol. 26, 1918; also *Report of the Smithsonian Institution for 1918*, p. 127-138. ISIS

Fotheringham, John Knight. Historical eclipses. Being the HALLEY lecture delivered May 17, 1921, 32 p. Oxford, Clarendon Press, 1921. ISIS

[**Geophysics**]. A survey of research problems in geophysics prepared by Chairmen of sections of the American Geophysical Union. *Proceedings of the National Academy of sciences*, t. 6, p. 545 601, 1920. ISIS

Geodesy, by WILLIAM BOWIE; seismology, by HARRY FIELDING REID; meteorology, by C. F. MARVIN; terrestrial magnetism and electricity, by LOUIS A. BAUER; physical oceanography, by G. W. LITTLEHALES; volcanology, by HENRY S. WASHINGTON; geochemistry, by ROBERT B. SOSMAN. G.S.

Perrin, Jean. L'origine de la chaleur solaire. *Scientia*, t. 30, p. 355-371, Bologna, nov. 1921. ISIS

Partant de l'hypothèse que le nucléon (noyau positif de l'atome d'H.) et les corpuscules, identiques entre eux, de masse 2000 fois plus faible environ que celle de l'atome d'H., sont les constituants universels de toute matière, J. P. pense que la condensation d'atomes légers en atomes lourds est l'origine de la chaleur solaire. (Cette théorie a d'abord été esquissée par l'auteur dans un travail très important : Matière et lumière, qui remplit à lui seul le numéro de décembre 1919 des *Annales de Physique*.) L. G.

Philip, Alexander. The improvement of the Gregorian calendar, 30 p. London, ROUTLEDGE, 1918. ISIS

Philip, Alexander. The calendar. Its history, structure and improvement, xi+104 p. Cambridge, University Press, 1921.

1818

Shapley, Harlow and Curtis, Heber D. The scale of the universe. *Bull. of the National Research Council*, t. 2, p. 171-217. Washington, 1921.

1818

7. — BIBLIOGRAPHY and LIBRARIES.

MacNair, Mary Wilson. A list of American doctoral dissertations printed in 1919. 167 p. Washington, Government printing office, Library branch 1921.

1818

A list of the 257 theses printed in 1919, plus a few additions to previous lists. For criticism, see *Isis*, IV, 439.

G. S.

Roberts, S. C. A history of the Cambridge University Press. 1521-1921, xv+190 p., illustr., Cambridge, University Press, 1921.

1818

8. — BIOLOGY.

Bateson, William. Evolutionary faith and modern doubts. *Science*, vol. 55, p. 55-61, 1922.

1818

Address delivered before the A. A. A. S., Toronto, 1921.

Bedot, Maurice. Essai sur l'évolution du règne animal et la formation de la société, 176 p. Paris, ALCAN, 1918.

1818

Bohn, Georges. La forme et le mouvement. Essai de dynamique de la vie, 174 p., Paris, FLAMMARION, 1921.

Caullery, Maurice. Le parasitisme et la symbiose (*Encyclopédie scientifique*), viii+400 p. Paris, DOIN, 1922,

1818

Caullery, M. La contribution que les divers pays ont donnée au développement de la biologie, *Scientia*, Bologna, t. 31, p. 23-47, janvier 1922.

1818

CAULLERY oppose surtout l'esprit allemand, « avant tout métaphysicien » à la tendance latine « qui procède de la philosophie positive d'Aug. COMTE », et qu'on retrouve aussi chez les Anglais. (Cette distinction ne peut avoir grande valeur, n'étant vraie que pour une époque, et dans celle-ci, que pour quelques savants.)

L. G.

Conklin, Edwin Grant. The direction of human evolution, xii+247 p. New York, SCRIBNER'S, 1921.

1818

Cunningham, J. T. Hormones and heredity : a discussion of the evolution of adaptations and the evolution of species, xx+246 p., 3 pl. London, CONSTABLE, 1921

1818

Reviewed by W. M. BAYLISS in *Nature*, vol. 109, 35-37, 1922.

Darwin, Léonard. The aims and methods of eugenical societies. *Science*, t. 54, 313-23, 1921.

1818

Knight, Melvin Moses; Peters, Iva L.; Blanchard, Phyllis. Taboo and genetics. A study of the biological, sociological and psychological foundation of the family. New York, MOFFAT, 1920.

1818

Kropotkin, Prince. The direct action of environment and evolution. *The Nineteenth Century and After*, January 1919. *Report of the Smithsonian Institution for 1918*, p. 409-427. ISIS

Leduc, Stéphane. L'énergétique de la vie. 195 p. (Etudes de biophysique, 3). Paris, A. POINAT, 1921. ISIS

Matisse, G. Le mouvement scientifique contemporain en France. I. Les sciences naturelles, 160 p. 25 fig., Paris, PAYOT et C^{ie}, 1921. ISIS

Premier volume d'un ouvrage d'ensemble sur le mouvement scientifique contemporain en France. Après un chapitre sur les laboratoires maritimes, l'auteur résume avec beaucoup de clarté, mettant en lumière les principes et les idées générales ayant une valeur scientifique et une portée philosophique, les travaux de Y. DELAGE, E. BATAILLON, Fr. HOUSSAY, L. CUÉNOT, G. BOHN, R. QUINTON, G. CHAUVEAUD, M. MOLLIARD, et L. MATRUCHOT, dont plusieurs sont morts sans qu'il en donne indication. Aucune conclusion. Quelques indications bibliographiques. L. G.

Piéron H. Du rôle et de la signification du conflit scientifique entre mécanisme et vitalisme. *Scientia*, Bologna, p. 115-127, fév. 1922. ISIS

Le mécanisme apparaît surtout comme un moteur, comme un facteur de recherche hardie, le vitalisme comme un frein, comme un facteur de contrôle timoré. L. G.

Petronievics, Branislav. On the law of irreversible evolution. *Science Progress*, January 1919. *Reprinted in report of the Smithsonian Institution for 1918*, p. 429-440. ISIS

This law was first formulated by the Belgian paleontologist LOUIS DOLLO, in 1893, even in 1892. According to the author, it is of considerable importance. Elaborate bibliography. G. S.

Rabaud, Et. L'Hérédité, 190 p. 34 fig., Paris, ARMAND COLIN, 1921. ISIS

Bonne mise au point du problème de l'hérédité et de la variation, avec exposé critique des conceptions mendéliennes les plus récentes, par un savant fortement imprégné de tendances néo-lamarckiennes. L. G.

Rabaud, Et. Eléments de biologie générale, 440 p. 51 fig., Paris, FÉLIX ALCAN, 1921 (Bibl. de Philos. contempor.) ISIS

Etude de la constitution de la substance vivante, du complexe milieu \times organisme, et des phénomènes qui découlent de cette interaction : formation des organismes pluricellulaires, accroissement et fractionnement des individus, adaptation et variation, hérédité, notion d'espèce, activité normale des organismes, leur répartition géographique, persistance et disparition des espèces, l'évolution phénomène physiologique. L. G.

Semon, Richard. The Mneme. English translation by LOUIS SEMON, 304 p. London, ALLEN and UNWIN, 1921 (not seen). ISIS

Translation of Die Mneme. Leipzig 1904, 3rd ed. 1911. G. S.

Woodruff, Lorande Loss. History of biology. *Scientific monthly*, t 12, p. 253-281, 1921. ISIS

A summary of this history. G. S.

9. — BOTANY.

- Bernard, Noel** (1874-1911). *Principes de biologie végétale*, xii + 212 p. 18 fig. Paris, **FÉLIX ALCAN**, 1921. 1818

Volume faisant suite à *L'Évolution des plantes*, paru en 1918. Ces deux publications forment un tout dans lequel sont exprimées et condensées les idées neuves et les recherches de ce savant qui, si jeune, était déjà un Maître. Un avant-propos, dû à M^{me} BERNARD donne des aperçus intéressants sur la façon dont N. B. concevait l'enseignement. [V. aussi la longue préface de *L'Évolution des plantes*, due à J. CONSTANTIN, et un bel article de CH. PÉREZ : NOEL BERNARD, dans la *Revue du Mois*, t. XI, p. 641-668, 10 juin 1911]. L. G.

- Berry, Edward W.** *Paleobotany. A sketch of the origin and evolution of floras. Report of the Smithsonian Institution for 1918*, 289-407, 6 pl. 1818

Preceded by a short historical introduction.

G. S.

- Braun-Blanquet, J.** *Prinzipien einer Systematik der Pflanzengesellschaften auf floristischer Grundlage. Jahrbuch der St. Gallischen Naturwiss. Gesellschaft*, 57. Bd., 2. Teil., p. 305-351, St. Gallen 1921. 1818

Followed by a "Versuch einer Anordnung der Pflanzengesellschaften nach ihrer soziologischen Progression". G. S.

- Goebel, Karl.** *Die Entfaltungsbewegungen der Pflanzen und deren teleologische Deutung. Ergänzungsband zur Organographie der Pflanzen*, viii + 483 p. Jena, **FISCHER**, 1920. 1818

Contains historical information.

- Rübel, Eduard.** *Die Entwicklung der Pflanzensoziologie. Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich*, t. 65, p. 573-604, 1920. 1818

Definition, aim and importance of plant sociology; its relation to the other branches of botany; its historical development; present state of these studies. G. S.

- Rübel, Eduard.** *Ueber die Entwicklung der Gesellschaftsmorphologie. The Journal of Ecology*, vol. 8, p. 18-40, Cambridge, 1920. 1818

"Die Pflanzensoziologie ist eine relativ neue Wissenschaft, sie hat wohl bei HUMBOLDT schon Anklänge, doch tritt sie erst bei GRISEBACH, bei SENDTNER, LORENZ und besonders bei KERNER selbständig auf und findet ihre Ausgestaltung bei HULT 1881, SCHRÖTER 1892 und WARMING 1895". G. S.

- Schuster, Julius.** *Das Herbarium in der Vergangenheit, Gegenwart und Zukunft. Herbarium, Organ zur Förderung des Austausch wissenschaftlicher Exsiccationsammlungen*, Leipzig, **THEODOR OSWALD WEIGEL**, Nr. 50, p. 504-510, 1919. 1818

A short history of herbariums. The oldest extant are preserved in Italy. Two dating from c. 1550 are in the Biblioteca Angelica in Rome; ALDROVANDI's dating from 1554 and containing 5095 plants is in Bologna. Then follow: ANDREA CESALPINO, 1563, 768 plants classified according to his own system; JEAN GIRAULT (not GREAULT), 1558; LEONHARDT RAUWOLFF, 1575 (kept in Leiden); HIERONYMUS HARDER, four herbariums 1574 to 1599; CASPAR RATZENBERGER, 1592, 1598. I do not quote the later ones. One finds allusions to older herbariums in herbals, but one may say that

they represent a development of the xvith cent. LINNÉ gave a tremendous impulse to their preparation. G. S.

10. — CHEMISTRY. PHYSICO-CHEMISTRY.

Brogie, M. de. Le type chimique et la substance des corps simples, *Scientia*, t. 30, 447-455, Bologna, déc. 1921. 1S1S

Sur les recherches de ASTON relatives aux isotopes, et quelques-unes de leurs répercussions, celle-ci par exemple: les éléments légers seraient formés à partir de H. avec un dégagement de chaleur, au contraire de ce qui se passe pour les éléments lourds. L. G.

Clibbens, Douglas A. The principles of the phase theory. Heterogeneous equilibria between salts and their aqueous solutions, xx + 382 p. London, MACMILLAN, 1920. 1S1S

Meldrum, Andrew Norman. The development of the atomic theory, ii + 13 p. Oxford University Press, 1920. 1S1S

Mercer, J. E. Alchemy. Its science and romance, x + 245 p., 4 ill. London, Society for promoting Christian knowledge, 1921. 1S1S

This book by the Right Rev. Dr. MERCER, sometime Bishop of Tasmania, is distinctly popular. The author's aim will be best defined in his own words: "This may perhaps claim to be an apology for alchemy. It attempts, to set forth, with more system and sympathy than is usual, its history, the doctrines it professed and the results it achieved. The defence is based on a critical estimate of the conditions under which the genuine adepts had to think and to work... I have availed myself freely of materials which are more or less easily accessible in modern treatises on the Hermetic art." Sources: BERTHELOT, FIGUIER, MUIR, THORPE, an article of HASTINGS' Encyclopedia of Religion and Ethics and some works of representative alchemists, especially of the earlier periods. G. S.

Patterson, Austin M. A French-English dictionary for chemists, xvii + 384 p. New York, JOHN WILEY, 1921. 1S1S

Tilden, Sir William A. Famous chemists. The men and their work, vi + 296 p., illustr. London, ROUTLEDGE, 1921. 1S1S

A series of brief but carefully written biographies of the following: I. ROBERT BOYLE, the father of chemistry; II. The phlogisticians: BLACK; PRIESTLEY; CAVENDISH; SCHEELE; III. The antiphlogistic revolution: LAVOISIER; IV. Electricity in the service of chemistry: DAVY; V. Laws of combination and the atomic theory: DALTON; GAY-LUSSAC; PROUST; BERZELIUS; VI. Electrochemistry: FARADAY; VII. Molecule and atom defined: AVOGADRO; CANNIZZARO; VIII. Early attempts at classification: LIEBIG; DUMAS; IX. Theories of chemical action and constitution of molecules: FRANKLAND; WILLIAMSON; X. Classification and nature of elements: MENDELEEFF; CROOKES; RAMSAY. There are many well-chosen portraits. Excellent introduction to the history of chemistry. G. S.

Vanizetti, B. L. De la contribution des divers pays au développement de la chimie. *Scientia*, t. XXX, p. 85-103. Bologna, Août 1921. 1S1S

Webster, David L. and Page, Leigh. A general survey of the present status of the atomic structure problem, *Bull. of the National Research Council*, t. 2, 61 p., Washington 1921. 1S1S

11. — ECONOMICS.

(*Economic doctrines and history. Commerce, Transportation and Communications.*)

Horner John. The Linen Trade of Europe during the spinning wheel period, xiv + 591 p. Belfast, McCaw, STEVENSON and ORR, Ltd. 1920. 1815

This book was begun about 14 years ago for the purpose of describing a number of flax-spinning wheels and accessories collected by the author in various parts of Europe and presented by him to the Belfast Museum. But he was gradually induced to expand the work into something like a history of the linen trade. After a brief introduction dealing with ancient conditions (including sketches by LEONARDO DA VINCI for a spinning-wheel and a two-spindle wheel), the author traces this history by countries. Ireland is given the lion's share (194 p.). Shorter sections deal successively with England, Scotland, France, Belgium and Holland, Germany, Austria-Hungary, Russia, Scandinavia, Spain and Portugal, Italy and Switzerland. The illustrations will be of special interest to the historian of technology.

G. S.

Morison. Samuel Eliot. The maritime history of Massachusetts, 1783-1860. Boston, HOUGHTON MIFFLIN, 1921. 1815

12 — EDUCATION.

(*Methods, Colleges, Universities.*)

Gray, John Milner. A history of the PERSE school, 162 p., 7 ill. Cambridge, BOWES and BOWES, 1921. 1818

Pfister, Chr. L'Université de Strasbourg, Paris, *Revue bleue*, p. 721-728, déc. 1921. 1816

Histoire de l'université de Strasbourg, écrite à l'occasion du III^e Centenaire de sa fondation par son actuel recteur. L. G.

13 — ETHNOLOGY.

(*Primitive and popular science.*)

Ball, W. W. Rouse. String figures. Second edition, 69 p. Cambridge, HARVARD, 1921. 1818

Carmichael, R. D. On the character of primitive human progress. *Scientific monthly*, t. 12, 53-61, 1921. 1818

Cook, O. F. Foot plow agriculture in Peru. *Report of the Smithsonian Institution for 1918*, p. 487-491, 4 pl. 1818

Cook, O. F. Milpa agriculture, a primitive tropical system. *Report of the Smithsonian Institution for 1919*, p. 307-326, 15 plates, Washington, 1921. 1818

This system is used generally by primitive peoples in the tropics. It is based on the cutting and burning of new areas of forest each year, in order to clear the land for maize or other crops. It is extremely wasteful.

G. S.

Fehlinger, H. Sexual life of primitive people. Translated by S. HERBERT and his wife, 133 p. London, BAKER, 1921. 1818

- Frazer, Sir James George.** Adonis. Etudes de religions orientales comparées. Traduction française par Lady FRAZER. (*Annales du Musée Guimet*, t. 29), vii + 316 p. Paris, GEUTHNER, 1921. ISIS

Ceci est la traduction française du commencement de la quatrième partie du Rameau d'Or (*The Golden Bough*). La traduction française paraît fort bien faite; il est évident que la traductrice s'est efforcée de préserver aussi complètement que possible la valeur artistique de l'œuvre de son mari. « L'idée fondamentale d'Adonis, comme celle d'Atys et d'Osiris, c'est la personnification des énergies vitales, c'est-à-dire la conception que les forces se manifestant dans la vie végétale et animale s'incorporent dans un personnage divin, dont alternativement la mort et la renaissance excitent par une sympathie universelle tous les phénomènes correspondants de la nature. » Voir *Isis*, I, 540. G. S.

- Frobenius, Leo.** Atlantis. Volksmärchen und Volksdichtungen Afrikas (*Veröffentlichungen des Forschungsinstituts für Kulturmorphologie*, München). Jena, DIEDERICHS. ISIS

An immense collection of African folktales edited by FROBENIUS; 15 volumes are foreseen, to be issued before 1926. I have seen vol. 6 entitled Spielmannsgeschichten der Sahel (350 p., with map and illustr., 1921). The plan of the collection is as follows: (1-3) Märchen der Kabylen; (4) Märchen aus Kordofan; (5) Sagen und Mythen des Sudan; (6) Spielmannsgeschichten der Sahel; (7) Die Dämonen des Sudan; (8) Erzählungen aus dem Westsudan; (9) Erzählungen aus dem Zentralsudan; (10) Die atlantische Götterlehre; (11) Erzählungen aus Oberguinea; (12-14) Mythen, Märchen, Tierfabeln der Kassaiden; (15) Regesten. The last volume will contain not simply indexes, but also maps and explanations relative to the whole series. G. S.

- Gardiner, J. Stanley.** Black coral as a charm against rheumatism. *Nature*, vol. 108, p. 505, 1921. ISIS

In Malay Archipelago. G. S.

- Hambruch, Paul.** Malaiische Märchen aus Madagaskar und Insulinde. (*Die Märchen der Weltliteratur*), iv + 331 p., 8 Taf. Jena, DIEDERICHS, 1922. ISIS

This selection of folktales from Madagascar and the East Indies is very carefully edited and beautifully illustrated. It contains not simply the Malay equivalents of Reineke Fuchs (Hikajat Pelanduk Djinaka) and Eulenspiegel but also cosmological stories of special interest to the ethnologist. It is completed by a bibliography with indication of the sources of each tale. I note in the preface that the first Ms. was discovered in 1603; it is the moralizing story, called « the Crown of the Kings » (Makota segala radjaradja). This book is got up in a very attractive manner. G. S.

- Hewitt, J. N. B.** A constitutional league of peace in the stone age of America. The league of the Iroquois and its constitution. *Report of the Smithsonian Institution for 1918*, p. 527-545. ISIS

- Hilton-Simpson, M. W.** Among the hill-folk of Algeria. Journeys among the Shawia of the Aurès mountains, 248 p., 40 ill. London, FISHER UNWIN, 1921. ISIS

Includes investigations on primitive medicine and surgery. G. S.

- Hopkins, E. Washburn.** The background of totemism. *Journal of the American Oriental Society*, vol. 38, p. 145-159. Reprinted in *Report of the Smithsonian Institution for 1918*, p. 573-584. ISIS

Löwis, August von. Finnische und estnische Volksmärchen. (*Die Märchen der Weltliteratur*), xv + 302 p. Jena, DIEDERICH, 1922.

1818

A selection of folktales from Finland, Esthonia, Livonia with brief introduction and bibliography. The two great epics of the Finnish Ugrian peoples have been largely drawn upon, the Finnish Kalevala and the Esthonian Kalevipoëg. See my note devoted to HAMBRUCH's collection, above. I will not mention in *Isis* other books of this series; it will suffice to say that its programme is very comprehensive. In fact it includes representative tales from every people of the world and will thus be a sort of encyclopedia of folk literature.

G. S.

Moloney, Michael F. Irish ethno-botany and the evolution of medicine in Ireland. 96 p. Dublin, GILL and Son, 1919.

1813

Irish ethno-botany (50 p.) is an attempt to establish the native materia medica of vegetable origin (Latin, English and Gaëlic names). The second part is a very rough and brief sketch of the history of medicine in Ireland. Gaelic, English and Latin indexes.

G. S.

Moriey, Sylvanus Griswold. The foremost intellectual achievement of ancient America. *The National Geographic Magazine*, vol. 41, p. 109-130. illustr. Washington, Feb. 1922

1818

A popular account of the hieroglyphic inscriptions on the Maya monuments in the ruined cities of Mexico, Guatemala, and Honduras. MORLEY's scientific account of his discoveries was reviewed in *Isis*, III, 292-294.

G. S.

Read, Carveth. The origin of man and of his superstitions, xii + 350 p. Cambridge, University Press, 1920.

1818

Roth, H. Ling. Studies in primitive looms (complete in four parts). 151 p., illustrated (Reprinted from the *Journal of the R. Anthropological Society*, t. 48) Halifax, KING, 1918.

1818

An elaborate study based on original material and abundantly illustrated. A model for similar investigations relative to other implements.

G. S.

Spinden, Herbert J. Central American calendars and the Gregorian day. *Proc. of the Nat. Acad. of Sciences*, t. 6, p. 56-59, 1920.

1813

Apropos of the dating of events in Central America in terms of the Gregorian calendar. SPINDEN believes this can now be accomplished, as far as the existence of monuments permits it, with greater accuracy than is the case for Egyptian, Greek or Roman events!!

G. S.

14. — GEOGRAPHY.

Berget, Alphonse. Les problèmes de l'océan, 330 p., Paris, FLAMMARION, 1920.

1818

Godée Molsbergen, E. C. Reizen in Zuid-Afrika in de hollandsche tijd. Eerste deel. Tochten naar het Noorden, 1652-1686. Tweede deel. Tochten naar het Noorden, 1686-1806. (Lindeschoten-Vereeniging, 2, 12), 's Gravenhage, M. Nijhoff, 1916.

1818

McEwen, George F. The science of oceanography. Special publications of BERNICE P. BISHOP Museum, No. 7, p. 597-607, 1921.

1818

McEwen, George F. The status of oceanographic studies of the Pacific. Special publications of BERNICE P. BISHOP Museum, No. 7, p. 487-497, 1921. 1313

Historical sketch, p. 487-489.

15. — GEOLOGY, MINERALOGY, PALEONTOLOGY, MINING.

(For paleobotany and paleozoology, see respectively botany and zoology.)

De Launay, L. Où en est la géologie, vi + x + 205 p., 13 fig., 1 frontispice sur bois de CH. HALLO, Paris, GAUTHIER-VILLARS et C^{ie}, 1921. (Coll. des Mises au point.) 1313

Introduction : I. Les problèmes de la sédimentation. — II. La tectonique ou orogénie. — III. L'histoire des océans. La Méditerranée, l'Atlantique et le Pacifique. — IV. Les relations de la géologie avec les autres sciences. — V. Métallogénie et sources thermales. — VI. Les méthodes nouvelles pour rechercher la houille, le pétrole et les minerais métallifères. L. G.

Gregory, Herbert A. History of geology. *Scientific monthly*, t. 12, p. 97-126, 1921. 1313

Origin of the earth; meaning of rocks; making of mountains; interpretation of natural scenery; meaning of fossils; geologic time scale; age of earth. G. S.

Rutot, A. L'Atlantide. *Bull. de l'Acad. de Belgique (sciences)*, p. 907-959, 1919. 1313

Wood, Harry O. A list of seismologic stations of the world. *Bulletin of the National Research Council*, t. 2, p. 397-538. Washington 1921. 1313

16. — HISTORY of CIVILIZATION

(General history. Historical methods. Biography and Chronology.)

Delehaye, Hippolyte (S. J.). L'œuvre des Bollandistes 1615-1915 (A travers trois siècles), 284 p. Bruxelles, bureau de la Société des Bollandistes, 22, boulevard Saint-Michel, 1920. 1313

Cette brève histoire est suivie (p. 245-282) d'un catalogue des publications bollandiennes : *Acta sanctorum*, *Anale ta Bollandiana*, *Subsidia hagiographica*, *Varia*, et de remarques fort utiles sur quelques publications pseudo-bollandiennes. G. S.

Lange, Christian Lous. Histoire de l'internationalisme. Vol. I, jusqu'à 1648. (*Publications de l'Institut NOBEL Norvégien*). Kristiania 1919 (London, WILLIAMS and NORGATE) 1313

17. — LANGUAGE and LITERATURE.

Mantzius, Karl (1860-1921). A history of theatrical art in ancient and modern times. With an introduction by WILLIAM ARCHER. Translated by LOUISE VON COSSEL, 6 vol. London, DUCKWORTH, 1903-1921. 1313

[**Transliteration**]. Transliteration of Slavonic. Report of the committee appointed to draw up a practical scheme for the transliteration into English of words and names belonging to Russian and other Slavonic languages. *Proceedings of the British Academy*, p. 523-542, 1917-1918. 1818

The committee included : Sir FREDERICK POLLOCK, Sir PAUL VINOGRADOFF, HAGBERG WRIGHT, MINNS, SETON-WATSON, NEVILL FORBES, HINKS. See also under *Islam*. G. S.

18. — LOGIC and THEORY of KNOWLEDGE.

Rougier, Louis. Les paralogismes du rationalisme. Essai sur la théorie de la connaissance, xiv + 540 p. Paris, ALCAN, 1920. 1818

Sheffer, Henry M. The general theory of notational relativity. 34 p., 48 fig. Cambridge, Mass. 1921 (at the author's, EMERSON Hall, Harvard University ; 250 typewritten copies). 1818

Outline of a new method in mathematical logic. " In a volume entitled *Analytic knowledge*, which the writer hopes to publish in the near future, this method -- which may be characterized as a sort of Prolegomenon to Every Future Postulate Set -- is developed in detail, and is then applied to the solution of a number of fundamental problems in logic, mathematics and *Mengenlehre*. " SHEFFER introduces the notions of propositional isotropy, stratigraphy and permutivity and proposes to base deductive logic upon them rather than upon propositional negation, implication, disjunction or incompatibility and upon the corresponding " ordinary " postulates (e. g. those of RUSSELL's *Principia*). Logic would thus be placed upon a superpostulational foundation. (A new edition is in the press). G. S.

19. — MATHEMATICS.

Brown, Ernest W. The history of mathematics. *Scientific monthly*, t. 12, p. 385-413, 1921. 1818

A summary of this history.

G. S.

Cajori, Florian. The spread of Newtonian and Leibnizian notations of the calculus. *Bull. Am. math. soc.*, vol. 27, p. 453-458, 1921. 1818

(1) Leibnizian notations in Great Britain; (2) Newtonian notations in continental Europe; (3) Calculus notations in the United States. G. S.

Charlier, C. V. L. La loi des grands nombres. *Scientia*, t. XXX, p. 433-439. Bologna, déc. 1921. 1818

Ce n'est pas par l'étude des trajets des particules individuelles (étoiles, atomes, etc.) qu'il est possible de résoudre l'énigme de l'univers, mais par application de la loi des grands nombres. L. G.

Dickson, L. E. Perfect and amicable numbers. *Scientific monthly*, t. 12, p. 349-354, 1921. 1818

Keyser, Cassius J. Mathematical philosophy. A study of fate and freedom. Lectures for educated laymen. New-York, Dutton, 1922.

Kowalewski, Gerhard. " Mathematica delectans. " Ausgewählte Kapitel aus der Mathematik der Spiele in gemeinverständlicher Darstellung 1. Heft : Boss puzzle and verwandte Spiele. 72 p., 24 fig. Leipzig, ENGELMANN, 1921. 1818

- Miller, G. A.** The group-theory element of the history of mathematics, *Scientific monthly*, vol. 12, p. 75-82, 1921. ISIS

MILLER divides the history of the group-theory into three periods : 1. The *implicit period* (to c. 1770) when the group concept was employed without being explicitly stated; 2. The *specialization period* (c. 1770 to c. 1870). The theory of substitution groups founded as an autonomous science and the usefulness of this theory in the study of algebraic equations emphasized; 3. The *generalization period* (from c. 1870 on), characterized by increased generalizations by abstraction and the explicit use of groups in each of the large domains of mathematics. G. S.

20. — MECHANICS.

- Bird, J. Malcolm (editor).** EINSTEIN'S theory of relativity and gravitation. A selection of material from the essays submitted in the competition for the EUGEN HIGGINS prize. New York, Scientific American, 1921. ISIS

- Bolton, Lyndon.** An introduction to the theory of relativity. xi + 177 p. London, METHUEN, 1921. ISIS

Winning essay of the above mentioned competition, amplified.

G. S.

- Cajori, Florian.** Falling bodies in ancient and modern times. *School science and mathematics*, vol. 21, p. 638-648, 1921. ISIS

A very well informed and clearly written study the burden of which is : (1) that GALILEO had correctly interpreted Aristotle's views on falling bodies (against GREENHILL, W. RAMSAY, O. LODGE); (2) that GALILEO performed experiments on this subject and that his *de motu* shows already more independence of thought than has been claimed (against WOHLWILL); (3) incidentally, that VIVIANI's biography of his master is in the main remarkably accurate and trustworthy. G. S.

- Cunningham, E.** Relativity, the electron theory and gravitation. Second edition. (*Monographs on physics*), vii + 148 p. London, LONGMANS; GREEN, 1921. ISIS

- Haldane, Viscount.** The reign of relativity, xxiii + 430 p. London, MURRAY, 1921; also New Haven, Yale Press. ISIS

- Nordmann, Charles.** EINSTEIN et l'univers. Une lueur dans le mystère des choses, 221 p. (21^e mille). Paris, HACHETTE, 1921. ISIS

Ouvrage de vulgarisation habile, mais un peu vulgaire. G. S.

- Wien, Wilhelm.** Die Relativitätstheorie vom Standpunkte der Physik und Erkenntnislehre. Vortrag, 36 p. Leipzig, BARTH, 1921. ISIS

21. — MEDICINE.

A. — History, Organization and Philosophy.

- Bleuler, Eugen.** Physisch und Psychisch in der Pathologie. Vortrag, 52 p. (*Z. für die gesamte Neurologie und Psychiatrie*, t. 30) Berlin, SPRINGER, 1916. ISIS

Bruck, Walther. Zahnärztliche Darstellungen aus alter Zeit. 71 p., 32 illustr. Berlin. Berlinische Verlagsanstalt, 1921. 1918

Publication of a lecture delivered by the author in Naubeim 1920. He has been collecting images relating to dentistry for many years and published his first book on this subject in 1915 (*Das Martyrium der heiligen APOLLONIA und seine Darstellung in der bildenden Kunst*). The present book is more comprehensive in its scope and also more popular. A first section is devoted to the martyrdom of St. APOLLONIA which has inspired many artists (the author has collected 160 representations of it). The rest of the material is divided into three sections: before, during and after the treatment. Of the 32 illustrations, 6 are of the xvth cent., 7 of the xvith, 16 of the xviith, 2 of the xviiith and one (borrowed from GUERIN's History, 1909) reproduces figures from a Seythian vase of Petrograd said to be of the vith or vth cent. B. C. (?) G. S.

Cabanès, Auguste. L'histoire éclairée par la clinique, 320 p. Paris, ALBIN MICHEL, 1921. 1918

Ces leçons professées à l'Institut des hautes études de Bruxelles en 1919-1920 nous donnent une philosophie de ces études qui doivent tant déjà au Dr. CABANÈS — non pas l'histoire de la médecine, mais plutôt l'interprétation médicale, la médecine de l'histoire. L'auteur insiste d'ailleurs sur cette distinction fondamentale au chapitre 7. Il étudie les rapports de la médecine d'une part et de la sociologie, de la philosophie, de l'histoire d'autre part. J'indique brièvement les titres des autres chapitres: la médecine, science auxiliaire de l'histoire; du rôle de l'individualité dans l'histoire; qu'entend-on par dégénérescence? Il n'y a pas de dégénérés supérieurs, il n'y a que des déséquilibrés; les historiens physiologiques (MICHELET, TAINÉ); la méthode scientifique: LITTRÉ et son école; origine de la psychopathologie historique; application des notions médicales à l'interprétation de l'histoire. G. S.

Cabanès, Auguste. La Salle de Garde. Histoire anecdotique des salles de garde des hôpitaux de Paris, 130 p., 9 pl., ill. Paris, MONTAGU, 1917. 1918

Chamberlain, Weston P. History of military medicine and its contributions to science. *Boston medical and surgical journal*, April 5, 1917 Reprinted in *Report of the Smithsonian Institution for 1918*, p. 235-249. 1918

Dock, Lavinia L. and Stewart, Isabel Maintland. A short history of nursing from the earliest times to the present day, vi + 3: 2 p. New York, PUTNAM, 1920. 1918

An abridgment of the standard History of Nursing written by M. ADELAIDE NUTTING and LAVINIA L. DOCK in 4 vol. New York, PUTNAM, 1907-1912.

Ebstein, Erich. Ärztebriefe aus vier Jahrhunderten mit Bildern und Schriftproben. xii + 204 p. Berlin, SPRINGER, 1920. 1918

Forgue. Sept siècles de chirurgie à Montpellier. *Rev. Internat. de l'Enseignement*, p. 21-42 Paris, janvier 1922. 1918

Gley, E. La véritable figure de la Faculté de médecine de Montpellier. *Revue scientifique*, p. 571-579. Paris, décembre 1921. 1918

Exposé historique, à l'occasion du septième centenaire de la Faculté de médecine, développé devant la Société des sciences méd. et biol. de Montpellier et du Languedoc, le 4 nov. 1921. L. G.

Koch, Richard. Die ärztliche Diagnose. Beitrag zur Kenntnis des ärztlichen Denkens, 127 p. Wiesbaden, BERGMANN, 1917. Zweite umgearbeitete Aufl., xv + 206 p., 1920 (not seen). ISIS

Lint, J. G. De. Volkstümliche Bilder auf dem Gebiete der Medizin in den Niederlanden. *Janus*, t. 24, p. 253-315, 1919. ISIS

Mackenzie, Sir James. The future of medicine, 238 p. London, FROWDE, 1919. ISIS

Mogk, Werner. Esslinger Wohlfahrtspflege im 15.-18. Jahrhundert (*Diss.*, SUDHOFFS Institut), 43 p. Leipzig 1920. ISIS

Based upon archival documents of Esslingen, the earliest dated 1496.

G. S.

Mourgue, Raoul. Note sur l'histoire de l'hygiène mentale en France. *Informateur des aliénistes et neurologistes*, janvier 1922. ISIS

Neuburger, Max. Die Entwicklung der Medizin in Österreich (Österreichische Bücherei, 2), 104 p. Wien, 1918. ISIS

The Austrian people may well be proud of the contributions which their physicians, and especially those of the Viennese school, have made to the development of medicine. MAX NEUBURGER has divided his story into three parts: (I) From MARIA THERESIA and her physician GERHARD VAN SWIETEN, i. e. from 1745 to the Congress of Vienna 1814-1815; (II) From 1815 to 1848; (III) Reign of FRANCIS-JOSEPH. G. S.

Saintyves, P. La médecine est-elle d'origine empirique? *Janus*, t. 24, p. 192-217, 316-325, 1919. ISIS

(III) La thérapeutique sacerdotale. (La rédaction de *Janus* a attribué par erreur la deuxième partie de ce travail, relative à la thérapeutique magique, à H. LECLERC — et cette erreur a été répétée dans *ISIS*); (IV) Empirisme et raisonnement dans la médecine mystique. G. S.

Sudhoff, Karl. Geschichte der Zahnheilkunde. Ein Leitfadens für den Unterricht und die Forschung, VIII + 206 p., 125 Abb. Leipzig, BARTH, 1921. ISIS

Vires. Sept siècles de médecine à la Faculté de Montpellier. *Revue Internat. de l'Enseignement*, p. 7-21. Paris, 15 janvier 1922. ISIS

B. — *Epidemiology. History and Geography of Disease.*

Andel, M. A. v. Quelques figures de lépreux dans l'art classique des Pays-Bas. *Janus*, 24^e année, p. 135-145, 6 illustr., 1919. ISIS

Effertz, O. Vergleichende Pathologie der Infektions-Krankheiten. *Janus*, 24^e année, p. 1-56, 1919. ISIS

Introduction and the first of four parts: Exzerpte aus den historischen Büchern der Missionsmönche über indianische Pathologie, nebst Kommentar. The author's theory of infection is: Virulentia hereditaria celerior immunitas hereditaria. G. S.

23. — PHARMACY and PHARMACOLOGY.

Laruelle, E. Les apothicaires rouennais. Histoire de la corporation du Moyen Age à la Révolution, VIII + 96 + LI p., 9 pl. Rouen, HENRI DEFONTAINE, 1920. [25 francs] ISIS

Étude fondamentale basée sur documents d'archives. De pareilles études

d'histoire locale sont indispensables parce que jusqu'à la fin du XVIII^e siècle la pharmacie ne fut pas régie par une loi générale s'appliquant à toute la France, mais par des règlements purement locaux. L'ouvrage se termine par le texte *in extenso* de 23 pièces justificatives datées de 1508 à 1764. Il est divisé comme suit : I. La corporation, origines, statuts, armoiries, fonctionnement, les maîtres, les gardes et leurs attributions, visites, expertises, recouvrement des impôts, grabelage, laboratoire et collège de pharmacie à Rouen au XVI^e siècle, conflit avec les épiciers. — II. La lettre de maîtrise. — III. La défense des intérêts professionnels, les procès, rapports avec les autres corporations. — IV. Les apothicaires privilégiés : apothicaires des hôpitaux, de la peste. — V. La confrérie. — VI. Quelques figures d'apothicaires, bibliographie. Il manque un index. G. S.

Reutter de Rosemont, L. Comment nos pères se soignaient, se parfumaient et conservaient leur corps. Remèdes parfums, embaumement, suivi d'un aperçu de l'histoire de la médecine et de la pharmacie dans l'ancien comté français de Neuchâtel (Suisse), 355 p., 38 illustr. Genève, GEORG, 1917. [9 francs.] 1818

La plus grande part de ce livre est consacrée à une étude de la cosmétique et de l'embaumement dans l'antiquité : I. De l'embaumement : a) chez les Egyptiens; b) chez les Carthaginois; c) parfums égyptiens; d) embaumement à travers les âges et son but. — II. Remèdes d'origine humaine et animale et parfums grecs, romains, carthaginois et gallo-romains (six chapitres de cette deuxième partie traitent de la drogue appelée *momie*). Ces études sont basées non seulement sur tous les documents littéraires, mais aussi sur des analyses chimiques faites par l'auteur et d'autres savants. Un appendice (25 p.) est consacré à l'histoire de la médecine et de la pharmacie à Neuchâtel depuis 1330; il eût mieux valu sans doute le publier à part, car il rompt l'unité de l'ouvrage. G. S.

25. — PHYSICS.

Adams, Edwin P. The quantum theory. *Bull. of the National Research Council*, t. 1, No. 5, 81 p. Washington, 1920. 1818

Bumstead, Henry Andrews The history of physics. *Scientific monthly*, t. 12, p. 289-309, 1921. 1818

Tabloid summary.

G. S.

Davis, Bergen. Intensity of emission of X-rays and their reflection from crystals. *Bull. of the National Research Council*, t. 1, p. 410-426, Washington, 1920. 1818

Duane, William. Data relating to X-Ray spectra. With a brief statement of their bearing on theories of the structure of atoms and the mechanism of radiation. *Bull. of the National Research Council*, t. 1, p. 383-408, Washington, 1920. 1818

Gehrcke, E. Physik und Erkenntnistheorie (*Wissenschaft und Hypothese*, 22), 119 p. Leipzig, TEUBNER, 1921. 1818

Divided into two main parts, the first devoted to generalities, the second to special concepts : space, time, motion, temperature, energy, scalars and vectors, dimensions, entropy, force, mass, atom, ether. G. S.

Hughes, Arthur Llewelyn. Report on photo-electricity including ionizing and radiating potentials and related effects. *Bull. of the National Research Council* t. 2, 87 p. Washington, 1921.

Jeans, James Hopwood. The dynamical theory of gases. Third edition, viii+442 p. Cambridge, University Press, 1921. 1815

First ed., 1904; 2nd, 1916. This third edition contains additions dealing with the quantum theory. G. S.

Sanford, Fernando. Some early theories regarding electrical forces. The electric emanation theory. *Scientific monthly*, t. 12, p. 544-550, 1921. 1815

GILBERT, 1600; — Rev. JOHN LYON. Experiments and observations on electricity, 1780. — NIC. CABAEUS, 1629. — Earl of STANHOPE. Principles of Electricity, 1779. — AEPINUS. Tentamen theoriae electricitatis et magnetismi, 1759. — CAVENDISH, 1771. G. S.

Sommerfeld, Arnold. Atombau und Spectrallinien. 2te Aufl. Braunschweig, VIEWEG, 1921. 1815

Thomson, J. J. Electricité et matière, traduit de l'anglais par MAURICE SOLOVINE, préface de PAUL LANGEVIN, x+134 p. (165×125). Paris. GAUTHIER-VILLARS et Cie, 1922. 1815

Traduction de conférences faites en 1903 à l'Université de Yale. La préface est une courte, mais bonne présentation du savant et de l'Université de Cambridge. Ce petit livre est orné de la reproduction d'un portrait très vivant de l'auteur. L. G.

Webster, David L. Problems of X-ray emission. *Bull. of the National Research Council*, t. I, p. 427-455. WASHINGTON, 1920. 1815

26. — PHYSIOLOGY.

Berman, Louis. The glands regulating personality. A study of the glands of internal secretion in relation to the types of human nature. 300 p. New York, MACMILLAN, 1921. 1815

Interesting but a little vulgar; too many loose statements. G. S.

Child, Charles Manning. The origin and development of the nervous system, xvii+296 p., ill. Chicago, University Press, 1921. 1815

Dufestel, Louis. La croissance, xvi+303 p. (Encyclopédie scientifique). Paris, DOIN, 1920. 1815

Mourgue, Raoul. L'activité statique du muscle Origine historique de cette notion. *Encéphale*, juin, 1921. 1815

28. — PSYCHOLOGY.

Hollander, Bernard. In search of the soul and the mechanism of thought, emotion and conduct. Vol I. The history of philosophy and science from ancient times to the present day. — Vol. II The origin and the mental capacities and dispositions of man and their normal, abnormal and super-natural manifestations, vii+361 p. London, KEGAN PAUL, etc., 1920. 1815

Mann, Walter. The follies and frauds of spiritualism, viii+191 p. London, WATTS, 1919. 1815

Mourgue, Raoul. Etude critique sur l'évolution des idées relatives à la nature des hallucinations vraies, 67 p. (*Thèse de médecine*. Paris, 1918-1919). Paris, Jouve, 1919. 1818

I. Les idées des Cartésiens. Les discussions à la Société médico-psychologique (1855-1856). Les idées de BAILLARGER, J. P. FABRET, etc. Les théories paraphrases. — II. Les théories anatomiques (PARCHAPPE, LUYSS et RITTI, TAMBURINI, TANZI). — III. Les théories de la dissociation et de l'automatisme mental (LEURET, MOREAU DE TOURS et les *états crépusculaires*, BALL, SÉGLAS, GILBERT BALLET). Tendances intellectualistes. — Bibliographie.

- Seul de tous les auteurs étudiés, BAILLARGER, dès 1846 (*Mém. de l'Ac. de médecine*, t. XII), a senti toute la difficulté de la question et conseillé avec la prudence du génie l'étude analytique des faits. - G. S.

Rignano, E Le fonctionnement de l'intelligence. *Scientia*, p. 197-223. Bologna, mars 1922. 1818

Cette communication — qui résume la thèse fondamentale émise par R. dans sa *Psychologie du raisonnement* (*Isis*, IV, 90-93) : le fonctionnement de l'intelligence est constitué par le jeu réciproque des activités sensorielles et mnémo-sensorielles et des activités affectives, — a été faite à une session extraordinaire de la Société française de Philosophie, tenue fin décembre 1921, à Paris. L. G.

Russell, Bertrand. The analysis of mind. 310 p. London, ALLEN; New York, MACMILLAN, 1921. 1818

Wall, Otto Augustus. Sex and sex worship (phallic worship). A scientific treatise on sex, its nature and function and its influence on art, science, architecture and religion with special reference to sex worship and symbolism. xv+607 p., ill. Saint-Louis, MOSBY, 1919. 1818

Warren, Howard C. A history of the association psychology, x+328 p. New York, SCRIBNER, 1921. 1818

Ziegler, Heinrich Ernst. Tierpsychologie (*Sammlung Göschen*). 115 p., 17 fig. Berlin, Vereinigung wissenschaftlicher Verleger, 1921. 1818

This little book is based upon lectures delivered by the author (already well-known by his book *Geschichte des Instinkt-begriffes*, 3rd ed. Jena, 1920) in Freiburg i. B., Jena and Stuttgart. It is divided into 3 parts: History of animal psychology and its relations to the development of religion and philosophy; Fundamental principles (reflexes, instincts, feelings, habits, memory, with special reference to the chimpanzees of Teneriffa and the performing dogs and horses); Psychical stages: (1) Protozoa (no nervous system); (2) Cnidaria (diffused nervous system); (3) Worms, arthropods, molluscs (ganglionic nervous system); (4) Vertebrates (animals with brains and spinal cord). Like the other volumes of this excellent collection, this one contains a large amount of information in a very condensed form. G. S.

29. — RELIGION. HISTORY of RELIGION. RELIGION and SCIENCE.

Patterson, L. Mithraism and Christianity A study in comparative religion, xi+102 p. Cambridge, University Press, 1921. 1818

Smith, David Eugene. « Religio Mathematici ». *American Mathematical Monthly*, October 1921; also *Teachers College Record*. New York, November, 1921. 1815

Ending up with interesting views on what D. E. SMITH calls the duality of mathematics and religion, twelve propositions being quoted both in mathematical and theological language. For ex., the laws relating to finite magnitudes do not hold respecting the infinitely large or the infinitely small = God's laws are so different from ours as to be absolutely nonunderstandable by us. G. S.

30. — SCIENCE.

A. — Bibliography.

Cobb, Ruth. Periodical bibliographies and abstracts for the scientific and technological journals of the world. *Bull. of the National Research Council*, t. 1, p. 131-154. Washington, 1920. 1815

Massart, Jean. Liste des recueils bibliographiques des sciences mathématiques, physiques, chimiques et naturelles. *Bull. de l'Ac. de Belgique (Sciences)*, 1919, p. 237-248. 1815

Pour chaque science les recueils sont classés en cinq groupes : a) Catalogues de titres sans résumés ; b) Recueils de résumés, où les ouvrages sont résumés au fur et à mesure de leur publication ; c) Annuaires où les résumés sont classés méthodiquement ; d) Monographies, où des questions sont mises au point par des spécialistes ; e) Recueils de références : catalogues d'espèces animales ou végétales (avec ou sans description), tables de constantes, description de corps nouveaux, etc. G. S.

B. — History.

Barnes, Harry Elmer. The historian and the history of science. *Scientific monthly*, t. 11, p. 112-116, 1920. 1815

(1) History of science and interpretation of history ; (2) General neglect of the history of science by historians ; (3) Present status of the history of science in American education ; (4) Necessity of cooperation between historians and scientists in the field of the history of science (with bibliography). G. S.

[Edinburgh.] Edinburgh's place in scientific progress. Prepared for the Edinburgh meeting of the B.A.A.S. by the local editorial committee. xvi + 263 p., with portraits. Edinburgh, CHAMBERS, 1921. 1815

Johnson, E. H. The present status of the history of science in American colleges and universities. *Science*, vol. 54, p. 585-595, 1921. 1815

Long, Esmond R. Democrats and aristocrats in scientific research. *Scientific monthly*, t. 12, p. 414-423, 1921. 1815

Contrasting different types of scientists and suggesting that it would be interesting to study them in pairs in the PLUTARCH manner. LONG compares briefly WILLIAM OSLER and EMIL FISCHER ; DARWIN and HUXLEY ; DAVY and FARADAY ; PASTEUR and HELMHOLTZ. G. S.

Miller, G. A. The history of science as an error breeder. *Scientific monthly*, t. 12, p. 439-443, 1921. 1815

Pennetier, G. Naturalistes normands (xv^e-xx^e siècles). Communication faite le 7 juin 1911 au Congrès du millénaire normand, 24 p. Rouen. LÉON GY, 1911. 1818

Pennetier, G. Discours sur l'évolution des connaissances en histoire naturelle I. L'antiquité et le moyen-âge, 56 p. — II. Renaissance, 69 p. — III. xvii^e siècle. 95 p. — IV. 1^o xviii^e-xix^e siècles. Aperçu général, doctrines biologiques. 80 p.; 2^o Géologie. 319 p.; 3^o Botanique, 368 p.; 4^e Zoologie (progrès et découvertes). 351 p. *Actes du Museum d'histoire naturelle de Rouen*, 1911-1920, fascic. 24 à 26. 1818

Ce travail comprendra encore trois fascicules, l'un de notices biographiques et bibliographiques relatif à la zoologie aux xviii^e et xix^e siècles, un fascicule consacré aux conclusions (science et philosophie); le dernier fascicule sera réservé aux tables. L. G.

Sarton, George. Third Report to the CARNEGIE Institution. Year Book no. 20, 426-427. Washington, CARNEGIE Institution, 1922. 1818

Report on my work from Sept. 1, 1920 to August 31, 1921 divided as follows: Introduction to the history and philosophy of science; Publication of *Isis*; New Humanism; Harvard lectures. G. S.

[**United States. History of science.**] The history of science at the St. Louis meeting of the American historical association. *Science*, vol. 55, 122, 1922. 1818

C. — Organization.

American Association for the Advancement of Science. Summarized proceedings of the 67th meeting (San Francisco. 1915); 68th meeting (Columbus. O.); 69th meeting (New York); 70th meeting (Pittsburgh); 71st meeting (Baltimore); 72nd meeting (St. Louis); 73rd meeting (Chicago 1920). Together with the Constitution and by-laws and rules of procedure adopted at the St. Louis meeting and also the List of fellows and other members corrected to June 15, 1921. Besides other information concerning the association. 712 p. Published by the Association. *Smithsonian Institution*, 1921. 1818

This list contains 11,934 names of American scientists, with titles and addresses. G. S.

Borel, E. La science dans une société socialiste. *Scientia*, p. 223-229. Bologna, mars 1922. 1818

BOREL indique comment pourraient être assurées les recherches scientifiques dans une organisation sociale pénétrée par les tendances socialistes. L. G.

Flinn, Alfred D.; A. J. Porskievics and Ruth Cobb. Research laboratories in industrial establishments of the United States of America. *Bulletin of the National Research Council*, t. 1, p. 45-130. Washington, 1920. 1818

Two hundred ninety-seven laboratories are named in alphabetical order, then follow classifications: geographical, scientific and technical, commercial. A revised and enlarged edition by RUTH COBB is in the press (*ibidem*, vol. 3). G. S.

Munby, A. E. Laboratories. Their planning and fittings. With a historical introduction by Sir ARTHUR E. SHIPLEY, xix + 220 p. London, BELL, 1921. 1S1S

Spiller, G. A new system of scientific procedure. Being an attempt to ascertain, develop and systematize the general methods employed in modern enquiries at their best, ix + 441 p. London, WATTS, 1921. 1S1S

Tassy, Edme et L  ris, P. Les ressources du travail intellectuel en France. xxi + 711 p. Paris, GAUTHIER-VILLARS, 1921. 1S1S

D. — *Philosophy.*

Strong, William Walker. The new philosophy of modern science, viii + 194 p. York, Pa. Kyle Printing Co., 1920. 1S1S

31. — SOCIOLOGY, JURISPRUDENCE and POSITIVE POLITY.

Barnes, Harry Elmer. The social history of the Western world. An outline syllabus. xii + 126 p. New York, APPLETON, 1921. 1S1S

Divided into six parts : prolegomena ; pre-literary period ; early civil. in the Near East including the Aegean civil. ; classical society ; middle ages ; modern times. The book is interesting and comprehensive but, in my opinion, far too succinct. To be truly useful (not simply as a crambook) the statements made should be at least three times longer and selected examples should be quoted. The bibliography is sufficient, but the dates of publication should be given. G. S.

Commons, John R and others. History of labor in the United States. With an introductory note by HENRY W. FARNAM. 2 vol. New York, MACMILLAN, 1921. 1S1S

Euken, Rudolf. Socialism. An analysis. 188 p. London, UNWIN, 1921. 1S1S

Translation by JOSEPH McCABE of *Der Sozialismus und seine Lebensgestaltung*. Leipzig, Reclam, 1920.

Lord, Arthur Ritchie. The principles of politics. An introduction to the study of the evolution of political ideas, 308 p. Oxford, Clarendon Press, 1921. 1S1S

Maunier, Ren  . Manuel bibliographique des sciences sociales et   conomiques. Pr  face de CHARLES GIDE, 228 p. Paris. TENIN, 1920. 1S1S

Purdom, Charles Benjamin (editor). Town theory and practice by W. R. LETHABY. GEORGE L. PEPLER, Sir THEODORE G. CHAMBERS, RAYMOND UNWIN and R. L. REISS 139 p. London, BENN, 1921. 1S1S

Sadler, Gilbert T. The relation of custom to law, viii + 86 p. London, SWEET and MAXWELL, 1919. 1S1S

Union des Associations Internationales. Bruxelles. Centre International. Conceptions et programme de l'internationalisme. Organismes internationaux et Union des associations internationales. Etablissements scientifiques install  s au Palais mondial, 130 p., 15 pl. Bruxelles, ao  t 1921. 1S1S

Programme fort clair, illustr   d'excellents diagrammes et de photographies

qui permettent de se rendre compte de la grande activité internationale créée par le génie organisateur de LA FONTAINE et OTLET à Bruxelles.

G. S.

Westermarck, Edvard. The history of human marriage. Fifth ed., rewritten, 3 vol. London, MACMILLAN, 1921. 1818

The standard book on the subject by a great scholar who has dedicated his whole life to it. His doctor's thesis at the University of Helsingfors in 1889 was already devoted to this very subject. In 1914 he published separately (MACMILLAN) the results of his investigations on the *Marriage ceremonies in Morocco*. G. S.

32. — STATISTICS.

Bisset-Smith, George T. The census and some of its uses. Edinburgh, GREEN, 1921. 1818

Boutroux, Pierre. Travaux statistiques relatifs aux mouvements de nos effectifs pendant la guerre. *Journal de la Société de statistique de Paris*, 1921, 180-189. 1818

Je signale cet article à cause de son intérêt méthodologique. L'auteur a tout à fait raison d'insister sur le danger que présente la publication de tableaux statistiques dont les données ne sont pas suffisamment précisées par un commentaire. Ceci entraîne forcément des erreurs qui discréditent les méthodes statistiques. G. S.

Bowley, Arthur Lyon. Official statistics. 63 p. Oxford University Press, 1921. 1818

Niceforo, Alfredo. Les indices numériques de la civilisation et du progrès, 211 p. Paris, FLAMMARION, 1921.

33. — SUPERSTITION and OCCULTISM.

Christesco, Stéfan. La relativité et les forces dans le système cellulaire des mondes Nouvelle étude de cosmogonie scientifique, 302 p., 10 fig., 4 tableaux. Paris, ALCAN, 1921. [12 frs.] 1818

Danmar, William. Modern Nirvanaism. The philosophy of life and death (With Phoenix we win!), iv+176 p. Second printing. Published by the author, 5 McAuley Ave., Jamaica, New York, 1921 (First printed in 1914). 1818

Lévi, Eliphas. Les mystères de la Kabbale ou l'Harmonie occulte des deux testaments contenus dans la prophétie d'ÉZÉCHIEL et l'Apocalypse de Saint JEAN, 261 p., 12 pl., 95 fig. Paris, EMILE NOURRY, 1920. 1818

Ce livre publié avec luxe est imprimé d'après un MS. autographe d'ÉLIPHAS LÉVI, rédigé en 1861 pour son disciple le baron J. DE SPILLADENI, qui le ceda à un autre disciple en 1880. Le texte et les illustrations pourront intéresser les historiens de la bêtise humaine, quoiqu'ils y trouveront sans doute peu de nouveauté : plus ça change, plus c'est la même chose. La publication d'un pareil livre prouve qu'on a tort de limiter le Moyen Age au xv^e ou xvi^e siècle : une bonne partie de l'humanité y patauge encore, hélas! G. S.

Mager, Henri. Les baguettes des sourciers et les forces de la nature. Pourquoi se meuvent les baguettes. Elles obéissent aux lois d'Ampère. Services que peuvent rendre les baguettes et les pointes rectangulaires reliées au sol par deux conducteurs. xi+423 p., ill., Paris, DUNOD, 1920. 1818

Murray, Margaret Alice. The witch-cult in Western Europe. A study in anthropology, 303 p. Oxford, Clarendon Press, 1921. 1918

Based chiefly on English sources (judicial records and contemporary chronicles), with occasional references to French, Flemish and American sources. The author has also had access to some unpublished trials among the Edinburgh Justiciary Records and also in the Guernsey Greffe. Continuity of the religion. Admission ceremonies. Assemblies. Rites. Organization. Familiars and transformation. With a bibliography; lists of covens and names of members; notes on "flying" ointments by A. J. CLARK, etc. G. S.

Thomas, Daniel Lindsey and Thomas, Lucy Blayney. Kentucky Superstitions, VIII + 334 p. Princeton University Press, 1920. 1918

34. — TECHNOLOGY.

[For mining, see geology; for industrial chemistry, chemistry.

See also Arts and Crafts.]

Boffiti, Giuseppe. Il volo in Italia. Storia documentata e aneddotica dell'aeronautica e dell'aviazione in Italia, XVII + 384 p. Firenze, BARBERA, 1921. 1915

This book is the first attempt to give a comprehensive history of aeronautics (in its broadest sense) in Italy. The author modestly declares that he has not tried to write a real history, but has simply offered a collection of documents. The book is divided into two almost equal parts: from ARCHYTAS to MONTGOLFIER, and from MONTGOLFIER to our own day; to put it more briefly, ancient history and modern history. The first part contains 12 chapters: (1) Down to the first century; (2) Patristic period; (3) Scholastic period; (4) DANTE and LEONARDO; (5) G. B. DANTI of Perugia; (6) xvth cent.: F. VERANZIO and G. B. PORTA; (7) Aeronautics in Italian literature; (8) TITO LIVIO BURATTINI of Venice; (9) LANA, Jesuit of Brescia (1631-87); BORELLI; (10) Their followers; (11) PIER JACOPO MARTELLI; (12) Experiments of TIBERIO CAVALLO of Naples at the eve of MONTGOLFIER's invention. One sees that a great deal of this first part is hardly concerned with the history of technology, but rather with the history of literary imagination; the second part is of necessity more technical; (13) First aerostatic experiments in Italy; (14-17) Various early ascensions; (18) Beginning of scientific aerostatics: F. ZAMBECCARI. Scientific ascensions of PASQUALE ANDREOLI and CARLO BRIOSCHI (Padova, 1808); (19) Ascensions by FRANCESCO ORLANDI; (20) Italian studies on dirigibility; (21) Aerostatic literature; (22) Return to the "heavier-than-air" machines (only 16 p.!). Two appendixes: one by RAFFAELLO GIACOMELLI on LEONARDO, the other by the count KLINCKOWSTROEM on T. L. BURATTINI (xvith cent). It is noteworthy that the earliest journal devoted to aeronautics was the *Giornale aerostatico* of Milano, Jan. 1784. The book is interesting but devoted mainly to what one might call the prehistory of flying. It is beautifully dedicated "a tutti coloro che tinsero il mondo di sanguigno imporporando il cielo dell'aurora d'un novello domani" G. S.

Chapuis, Alfred (avec la collaboration de GUSTAVE LOUP). La montre « chinoise » (Relations de l'horlogerie suisse avec la Chine), XIII + 272 p., 33 pl., 245 fig. Neuchâtel, VICTOR ATTINGER [s. d., 30 fr.; relié, 43 fr.]. 1913

Cette luxueuse publication nous retrace l'histoire fort intéressante des montres fabriquées en Suisse pour l'exportation en Chine. Les montres

« chinoises » sont, en effet, simplement des montres d'un calibre et d'un type spéciaux faites « pour la Chine ». Cette industrie s'est localisée à Genève et surtout à Fleurier. L'auteur a pu tirer grand profit de l'admirable collection de montres rapportée par GUSTAVE LOUP de Genève. LÉOPOLD DE SAUSSURE a contribué à l'ouvrage par une note introductive (18 p.) sur l'horométrie et le système cosmologique des Chinois. Voici comment le sujet est divisé : I (jusqu'au Premier Empire français inclus) : 1° Premières relations horlogères avec la Chine; 2° Les ateliers impériaux d'horlogerie; 3° Deux horlogers suisses en Chine à la fin du XVIII^e siècle; 4° Un commerçant suisse en Chine à la fin du XVIII^e siècle : CHARLES DE CONSTANT; 5° Les montres Louis XV, Louis XVI et Empire. — II : 6° Les premiers Bovet de Chine (1818-1840); 7° Factoreries de Canton (1836-1843); 8° L'horlogerie suisse et la Chine après 1842; 9° La montre chinoise de Fleurier; 10° Les peintres sur émail et la montre chinoise (1820-1900); 11° Questions secondaires (p. ex. : les paires de montres; beaucoup de montres se vendaient en Chine par paires; leur expédition); 12° Diverses autres montres; 13° Pièces à musique; 14° Montres-bijoux; 15° Commerce de la montre en Chine; 16° Questions d'aujourd'hui. Il y a un appendice de 6 pages sur l'observatoire fondé par les PP. Jésuites à Zi Ka-Wei (illustré) et un index copieux. Il ne peut s'agir de résumer plus en détail cette importante monographie industrielle qui intéressera l'historien de la technologie, mais plus encore l'historien de l'industrie horlogère et celui des arts appliqués. Les illustrations sont fort nombreuses et fort belles. Plusieurs planches en couleur, par exemple, nous permettent de juger de la beauté des émaux avec lesquels les artistes genevois embellissaient les montres de leurs compatriotes. G. S.

Delany, Mary Cecilia. The historical geography of the Wealden Iron industry. 62 p., 3 maps (*Historico-geographical monographs*). London, BENN, c. 1921. 1818

Fiske, Raer Admiral Bradley, A. Invention. The master key to progress. ix+356 p. New York, DUTTON, 1921. 1818

Laking, Sir Guy Francis (Bar.). A record of European armour and arms through seven centuries. With an introduction by the Baron de Cosson, 5 vol. London, BELL, 1920-1922. [15 guin.] 1818

Luckiesh, M. Artificial light. Its influence upon civilization, xiv+306 p., ill. New York, Century, 1920. 1818

Osgood, Ellen Louise. A history of industry, vii+430 p. Boston, GINN, 1921. 1818

Robertson, Frederick Leslie. The evolution of naval armament. vi+307 p., ill. London, CONSTABLE, 1921. 1818

[**Technos.**] Revue analytique des publications techniques françaises et étrangères, paraissant tous les mois. Paris, E. CHIRON, 1920. 1818

Une nouvelle revue bibliographique contenant des analyses de chaque article cité, imprimée au verso des pages seulement pour le découpage. Le n° 17 (p. 2164 à 2356) a paru en août 1921. L'ordre suivi dans chaque numéro est : mines; métallurgie, constructions et travaux publics; industries mécaniques; industries électriques; locomotion; chimie et industries diverses; généralités techniques; économie industrielle. Prix de l'abonnement annuel : 60 francs, en France; 70 francs, à l'étranger. G. S.

Warner, Sir Frank. The silk industry of the United Kingdom. Its origin and development, 66+ p., 54 pl. London, DRANE'S 1921. 1818

35. — ZOOLOGY.

Bouvier, E. L. Habitudes et métamorphoses des insectes, 321 p. Paris. FLAMMARION, 1921. ISIS

Carpenter, George Herbert. Insect transformation, x+282 p., 4 pl., 124 ill. London, METHUEN, 1921. ISIS

Cuénot, L. La genèse des espèces animales, 2^e édit. entièrement refondue, viii+558 p., 109 fig. Paris, FÉLIX ALCAN (Bibl. scientif. internat.), 1921. ISIS

Cette édition diffère très notablement de la première (1911). Toute la deuxième partie de celle-ci (étude sur l'individu) a maintenant disparu, au profit d'un développement plus grand et d'une mise au courant de ce qui est relatif au peuplement de la terre, et surtout de la partie concernant les facteurs de l'évolution, où l'auteur fait une distinction entre mutations et som-mations (anciennement fluctuations), et continue à ne pas admettre l'hérédité des caractères acquis. Est aussi très notablement accru le long chapitre qui traite de la genèse des espèces et des adaptations. La première partie du volume est une histoire très condensée de l'évolutionnisme. — Bonne bibliographie. Manque une table analytique. L. G.

Gudger, E. W. Rains of fishes. *Natural history*, vol. XXI, p. 607-619. New York, 1921. ISIS

GUDGER's work in connection with the Bibliography of Fishes, edited by BASHFORD DEAN and now nearing completion, has made it possible for him to survey the whole evidence relative to the so-called "rains of fishes". The oldest account is that given by ATHENÆUS of Naucratis (end of iiii cent.) in *The Deipnosophists or Banquet of the Learned*, first printed in 1524 (Aldine); the next one is ROBERT CONNY's in the *Transactions of the R. S.*, 1698. The third account was given by RAPHAEL EGLINI in the *Wittenbergischen Wochenblatt* for 1771 with a correct explanation, *i. e.* transportation of the fishes by a waterspout or an overflow. The other accounts belong to the xixth cent. Of them I will quote only that of ALEX. von HUMBOLDT in 1823, relating the spreading of mud and fishes over about 43 square miles by a volcanic eruption. A discussion of all cases recorded by modern observers leads to the conclusion that the most usual cause of such spreading is the action of heavy winds, whirlwinds and waterspouts. Extensive bibliography. G. S.

Gurney, J. H. Early Annals of Ornithology, iv+240 p., ill. London. WITHERBY, 1921. ISIS

"The idea with which this little volume originated was to collect all the ancient passages about birds, of any special interest, but more particularly those which concerned British Birds, and to string them together in order of date": (1) Prehistoric birds; (2) ivth to ixth cent.; (3) xth to xith cent.; (4) xith cent.; (5) xiiith cent.; (6) xivth cent.; (7) xvth cent.; (8-10) xvith c.; (11) The crane, bustard, spoonbill and bittern; (12-13) xviiith cent.; (14) xviiith cent. Index. G. S.

Hills, John Walter A history of fly fishing for trout. London, ALLAN, 1921. ISIS

Jenkins, J. T. A history of the whale fisheries. From the Basque fisheries of the tenth century to the hunting of the finner whale at the present date, 336 p., 12 ill. London, WITHERBY, 1921. ISIS

This will fill a gap in the history of whaling, for there was no British

account comparable to F. S. MÜLLER's *Geschiedenis der Noordsche Compagnie*, Utrecht, 1874, for the Dutch whaling; L. BRINNER's *Die deutsche Grönlandfahrt*, Berlin, 1912, for the German; or W. S. TOWER's *History of the American whale fishery*, Philadelphia, 1907. JENKINS' account is based chiefly upon the original writings of the whalers. It is a story full of romance which should help to bring about a regulation of this industry, without which whales and whaling will soon be things of the past. Twenty pages tell the story to 1623; then follows an account of the period from 1623 to 1750 when Dutch whalers were predominant, etc.

G. S.

Macewen, William. The growth and shedding of the antlers of the deer, the histological phenomena and their relation to the growth of the bone, xvii+108 p. ill. Glasgow, MAC LEHOSE, 1920.

1818

Topsent, E. Histoire abrégée du Musée zoologique de l'Université de la Ville de Strasbourg. Paris, *Bull. Soc. Zool.*, t. 45, p. 7-13, 1920.

1818

ERRATA.

For previous errata see vol. II, 480; vol. III, 155, 503; vol. IV, 220.

Vol. II, p. 315, l. 13 : read *spared us* instead of *spared to us*.

Vol. III, p. 3, l. 32 : read *uninterrupted*.

Vol. III, p. 5, l. 18 : read *material*.

Vol. IV, p. 32, l. 4 : read *to draw attention to*.

Vol. IV, p. 33, l. 8 : read *excursion into*.

Vol. IV, 161, under **Arnot, F. S.** read London, SEELEY, 1921 (not 1920).

Vol. IV, 205 : under **Physiology** read ARTHUS, MAURICE (not ARTHUR).

Authors' Index.

The Roman figures refer to centuries; the other words, as China, astronomy, etc., refer to the sections of Parts II and III bearing these titles. The index will enable one to find more easily the papers analyzed in the present bibliography, and also to see at a glance what each writer is doing.

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